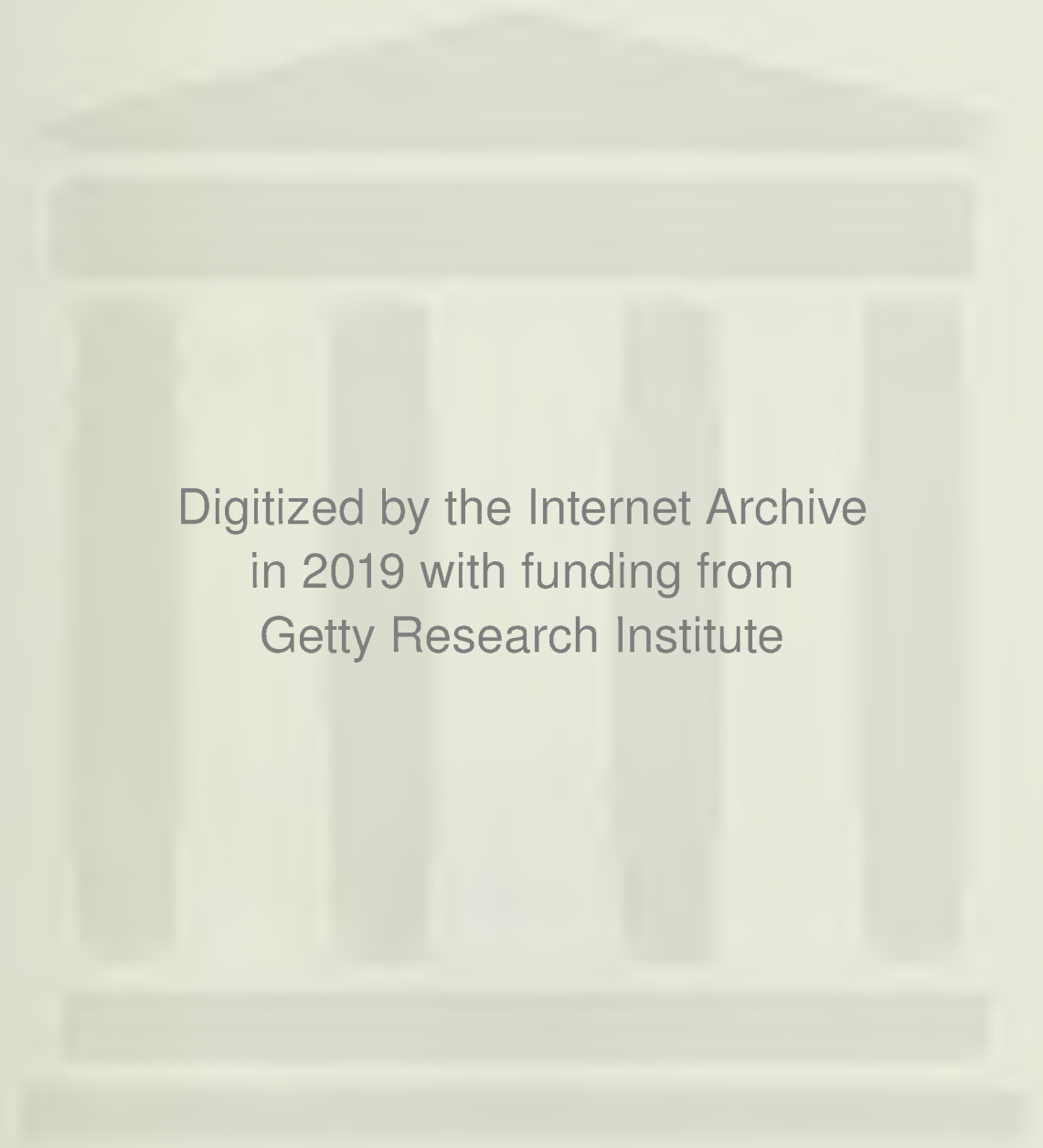
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SIXTEENTH ANNUAL REPORT

OF THE

BUREAU OF AMERICAN ETHNOLOGY

TO THE

SECRETARY OF THE SMITHSONIAN INSTITUTION

1894-'95

BY

J. W. POWELL
DIRECTOR

WASHINGTON
GOVERNMENT PRINTING OFFICE
1897

LETTER OF TRANSMITTAL

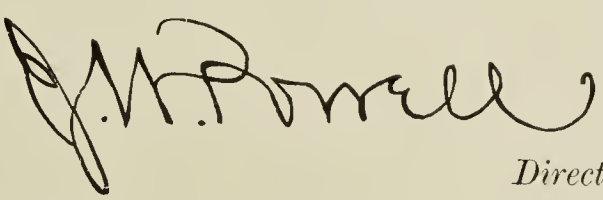
SMITHSONIAN INSTITUTION,
BUREAU OF AMERICAN ETHNOLOGY,
Washington, D. C., September 27, 1895.

SIR: I have the honor to submit my Sixteenth Annual Report as Director of the Bureau of American Ethnology.

The first part consists of an exposition of the operations of the Bureau for and during the fiscal year ending June 30, 1895; the second part consists of a series of papers on anthropologic subjects, prepared by collaborators to illustrate the methods and to set forth the results of the work of the Bureau.

I desire to express my thanks for your constant support and your wise counsel relating to the work under my charge.

I am, with respect, your obedient servant,



Director.

Honorable S. P. LANGLEY,
Secretary of the Smithsonian Institution.

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REPORT OF THE DIRECTOR

SIXTEENTH ANNUAL REPORT

OF THE

BUREAU OF AMERICAN ETHNOLOGY

By J. W. Powell, Director

INTRODUCTION

Researches relating to the American Indians were continued throughout the fiscal year ending June 30, 1895, in conformity with law.

The end of research is the discovery of relation. The recognition of relation is knowledge. The final relations, toward which all knowledge tends, are those connecting intelligent man with the universe of which he forms a part.

Knowledge progresses not only by extension but also by intension; i. e., as the field extends, so also knowledge becomes more definite, more significant, more useful, and in every way closer to the intelligent being. So knowledge begins with the remote and proceeds toward the near. The stars were studied, and first astrology and afterward astronomy came; the remoter lands were explored, and geography arose; gems and rare earths were examined, and first alchemy and then chemistry developed; imported and unusual plants at first and afterward common plants were investigated, and botany grew up; animals were subjected to research, and zoology became a science; mountains and mines and afterward local rocks and soils were studied, and geology was organized; last of all, mankind came to be investigated in their various aspects, and anthropology came into being. Throughout this history the

field of recognized relation constantly expanded, yet still more importantly the recognition of relation gradually became definite and approached nearer and nearer to the knower. Even within anthropology the same course has been extended; at first man was considered an animal, while the essentially human attributes were ignored; but gradually these attributes were recognized and combined under demonomy, or the great science of humanity, as set forth in the last report. In demonomy the relations recognized are numerous and complex, comprising as they do all those recognized in the earlier sciences, together with many others; yet it has been found inexpedient properly to define the races and peoples of the world, including the tribes of America, without analysis and synthesis of these relations.

The multifarious relations of mankind, among each other and with the cosmos, are best expressed in terms of activities, or activital products. On examining the activities, it is found that they are modified by time and conditions, i. e., that they are at once products and prototypes of development; and clear indications are found that they were originally adaptive and undifferentiated, though they are now purposive and fairly differentiated among the known peoples of the earth, especially the higher races. Although these activities are so closely interrelated as to be interdependent (e. g., just as chemistry and geology are interdependent), they fall naturally into five categories; and each category may justly be regarded as constituting the object matter of a science. Accordingly, the great science of demonomy comprises five subsciences, each so comprehensive and important as to take rank with the older sciences. The five categories of activities may be characterized briefly and in some measure provisionally:

1. The primary activities, which root in vital processes, are connected with pleasurable sensations. They arise in a certain order; among known primitive peoples they appeal chiefly to the senses, and among more advanced peoples they appeal more largely to the emotions, fixed sentiments, and intellectual qualities; they mature in the fine arts or esthetics, primitive and advanced, which need not now be characterized in detail. The science of these activities has been more or less clearly

recognized during recent years; it is commonly called *esthetology*, and this designation is acceptable.

2. Intimately connected with the primary activities, and also rooting in vital processes though becoming dominant only by organization through exercise and volition, there are others connected with physical well-being. These activities also arise in a certain order which need not now be developed; they mature in arts of welfare, or industries. The science of industries has long been recognized more or less clearly, and is acceptably known as *technology*. Both esthetics and industries, originating as they do in vital processes, are primarily individual, though they become collective through combination with higher activities.

3. The activities of the third category pertain to collective relations. Initially they are connected with consanguinity, and later with affinity on whatsoever basis; among savage peoples they are expressed in the organization of family and clan; among barbaric peoples they are expressed in the family, gens, and tribe; and among more advanced peoples in the family, state, nation, and alliance, with their various ramifications. These essentially collective activities root in biotic processes, chiefly reproductive, and mature in government. By some they are regarded as constituting the essential attributes of mankind, and have been combined and discussed under the designation of *sociology;* this name is acceptable, though it seems preferable to restrict its use to the branch of demonomy best recognized when it was coined; thus employed, sociology may be defined as the science of collective control, or, more briefly, the science of governments.

4. The activities of the fourth category are essentially collective and artificial; they are connected with expression, pantomimic, oral, and graphic. These activities also arise in a certain order with human development, as has been made known largely through researches in the Bureau. This order need not now be set forth in detail, though it may be noted that, since the activities of language are essentially demotic, their course of development is unlike that of living organisms, and may be characterized as involutionary rather than evolutionary—i. e., the lines of development are convergent rather

than divergent as among animals and plants. These activities may be combined as languages or arts of expression; a part have long been recognized as linguistics or *philology;* and, although the latter term is not wholly unobjectionable, it would seem best to adopt it, with enlarged definition, and apply it to the fourth science of humanity.

5. The activities of the fifth category represent the integration and summation of all the other activities; they are essentially intellectual and grow out of the interaction of intelligent beings among each other and with the cosmos. They comprise inferences, conclusions, abstractions, beliefs, and all other forms of knowledge or pseudo-knowledge; they arise in a certain order which is of great significance, but which need not here be detailed; they mature in that definite and comprehensive knowledge which is called science. These activities are so many-sided and ill-recognized that they have not been combined hitherto, and are not named in the vernacular; their products may perhaps best be denoted as opinions. It is to be observed that the principal activities connected with opinions are (1) instruction and (2) acception, both of which are essentially collective and pertain to the individual only as a member of the group. The science of opinions, including the activities of promulgation and acception, may be called sophiology (*σοφία*, knowledge, and *λόγος*, discourse).

The organization and definition of the demotic sciences in such manner as to yield a definite basis for a scientific classification of the races and peoples of the earth, including the tribes of America, is one of the results flowing from the work of the Bureau since its institution in 1879. It is thought that this general work has now reached such a stage as to afford trustworthy standpoints for future work in ethnic classification.

As during previous years, the operations of the Bureau have been carried forward in accordance with law and with plans shaped by experience. As in the last report, the details of the operations are set forth in a series of periodical progress reports and a general summary, prepared for transmittal to the Secretary of the Smithsonian Institution. These reports are incorporated herein as a detailed exhibit of work and progress.

PROGRESS REPORTS

OPERATIONS DURING JULY

The work of the Bureau during the month has been almost exclusively confined to such researches as may be prosecuted in the office, the only field operations conducted being the surveys by Mr Cosmos Mindeleff in the pueblo region of the southwest.

The Director severed his connection with the United States Geological Survey at the close of the last fiscal year, and with the beginning of the month of July began to give exclusive attention to the conduct of this Bureau, and to summarizing and correlating its past researches and formulating plans for future investigation and publication.

Work in sign language—Colonel Garrick Mallery continued during the month the preparation of his report on gesture signs and signals, and his comparative studies have been satisfactorily prosecuted. The numerous inquiries concerning this report and the cognate study of pictography which have of late reached the office evince the interest in these subjects awakened by the appearance of the monograph on "Picture-writing" contained in the recently published Tenth Annual Report, and by the prospect of the publication of the forthcoming memoir on sign language.

Work in Indian hieroglyphics—The researches by Dr Cyrus Thomas relating to the character and significance of the codices and other inscriptions of the Maya and related peoples were carried forward during the month. Dr Thomas reports that the progress of the work develops many suggestive hypotheses and establishes significant coincidences, agreements, and verifications. It is expected that a bulletin on this subject, withheld pending confirmation of provisional conclusions deduced from these researches, will presently be forwarded for publication.

Work in eastern archeology—The preparation of illustrations for the reports by Professor W. H. Holmes on this field was continued during the month, and the photographing, in connection therewith, of the aboriginal groups at Piny branch,

under the supervision of Mr F. H. Cushing and with the assistance of Mr William Dinwiddie, was concluded during the early days of the month. Besides this work, Mr Dinwiddie was engaged also in the elaboration of his report on the results of the investigations made a few months since at the Clifton steatite quarry.

Work in western archeology—Mr Cosmos Mindeleff has continued his researches in the pueblo archeology of San Juan valley in New Mexico and Arizona. This region has been found to have been strikingly adapted to the needs of the old pueblo-builders, and it affords examples of nearly all the types of aboriginal villages now known, together with other types and many variants which have not elsewhere been observed, and the examination and comparative study of which tend to a clearer elucidation of the development of art in architecture attained by the people of the pueblos.

Work in synonymy—As during previous months, Mr F. W. Hodge carried forward his work on the tribal synonymy of the southwestern aborigines. Most of the month, however, was devoted to the care of the library (which, Mr Hodge reports, has received a large number of accessions by gift or exchange) and to correcting the proofs of the "accompanying papers" in the Thirteenth Annual Report and of Professor Holmes' bulletin on "An Ancient Quarry in Indian Territory."

Mr James Mooney was occupied during the larger portion of the month in arranging and classifying material obtained from the Cherokee, Kiowa, and other Indian tribes. Galley proof of Mr Mooney's bulletin on the "Siouan Tribes of the East" began to come in during the closing days of the month.

Work in mythology—Mr Frank Hamilton Cushing was engaged during the month in the revision of proofs of his memoir on "Zuñi Creation Myths," which is now going through the press as one of the papers accompanying the Thirteenth Annual Report.

Mrs Matilda C. Stevenson was occupied in carrying forward her Zuñi monograph, which is progressing toward completion.

Work in linguistics—By reason of illness, Mr J. Owen Dorsey was able to devote only the later part of July to his

researches in Indian linguistics. His work during the period mentioned consisted of (1) the preparation of a catalog of the Teton-Dakota manuscript of Messrs Bushotter and Bruyier in the possession of the Bureau, and (2) the continuation of his work on the Winnebago texts and dictionary slips described in previous reports.

Dr Albert S. Gatschet continued his study of the Shawnee material. Many lexic and grammatic elements were extracted for the Shawnee dictionary and grammar, and such of the material as will aid in developing the ethnologic study of the people and its tongue was arranged and classified.

Mr J. N. B. Hewitt continued work on the Tubari material collected by Dr Carl Lumholtz, consideration being given chiefly to the revision of translations of songs and phrases in that tongue. Subsequently the preliminary study of the Maya and Malay languages, necessary for the purpose of examining the question of their conjectured relationship raised by Dr Thomas, was undertaken by Mr Hewitt, and at the close of the month he had finished the comparison of the pronominal and numeral systems of the two languages.

Work in bibliography—Mr James C. Pilling was engaged during July in prosecuting the work detailed by him in his report for June—the cataloguing of material relating to the languages of North America south of the United States. The progress of the work has been satisfactory, and the alphabetic list of authors in the bibliography has been advanced to the middle of the letter C.

Publications—Of the annual reports of the Bureau of American Ethnology, the eleventh and twelfth, which have been in the bindery for some time, are daily expected to be delivered for distribution. Much progress has been made in the revision of the proofs of the thirteenth, all the galleys having been received and much of the matter being in second revise. The material for the fourteenth report is ready for transmission, but is held pending the passage by the Senate of the resolution authorizing its publication.

The reading of the proofs of Dr Boas' bulletin on "Chinook Texts" is now nearing completion, 12 signatures having already

been approved for stereotyping. A bulletin by Mr Mooney on the "Siouan Tribes of the East" was forwarded for publication during the month, and proofs were received about the end of July. Professor Holmes' bulletin on an "Ancient Quarry in Indian Territory" is now on the press, and it is expected to be ready for distribution within a short time.

OPERATIONS DURING AUGUST

The work of the month has been conducted chiefly in the office, the field work being limited to the completing of operations by Mr Cosmos Mindeleff in the pueblo region, with certain work among the Kiowa, Comanche, and Apache Indians, on their respective reservations, by Mr James Mooney.

Work in sign language—Colonel Garrick Mallery continued the preparation of his report on Indian sign language with gesture signs and signals. A considerable part of the month was spent in the arrangement of illustrative material executed during preceding months, and this is now practically completed.

Work in Indian hieroglyphics—Dr Cyrus Thomas continued his work of collecting and arranging data relating to the hieroglyphs, calendars, etc, of the Maya. Dr Thomas has recently observed highly suggestive indications of relation not simply between the calendars of Yucatan and Mexico and those of the Orient, but certain strong suggestions of linguistic affinity, and of late his researches concerning the latter phase of the subject have been pursued with great avidity. Although the linguistic similarities thus far brought to light can hardly be regarded as expressing affinity, they seem to be worthy of close attention, and Dr Thomas has given much thought and time to collecting and tabulating them.

Work in eastern archeology—The chief work in this division during the month was the transfer of material to the National Museum. A large quantity of implements, blanks, rejects, etc, accumulated by Professor Holmes and used largely for illustrative material, hitherto stored in the office of the Geological Survey, was during the month formally transferred to the Museum. Mr William Dinwiddie and Mr Henry Walther had charge of the work.

Mr Dinwiddie spent a part of the month in the elaboration of notes on the soapstone quarry at Clifton, Virginia, and transferred to the Museum for temporary storage and further study, pending the final transfer, the most instructive part of the rich collection from that locality.

Since the retirement of Professor Holmes, the work in eastern archeology has been conducted under the more immediate direction of the Ethnologist in Charge.

Work in western archeology—Mr Cosmos Mindeleff continued throughout most of the month, and before its end brought to a close, his surveys in the pueblo country of New Mexico and Arizona. Mr Mindeleff's researches have covered a large territory and will permit archeologic mapping of considerable value, even the negative results being of use as indicating the territory barren of aboriginal works, while the positive results comprise information relating to previously unknown localities of aboriginal activity. Substantial additions to knowledge of habits and customs will also flow from his surveys and researches.

Work in synonymy—Mr F. W. Hodge continued his work on the tribal synonymy of the southwestern Indians as opportunity offered. The greater part of his time, however, was devoted to editorial work, and another part to the administration of the library. For several months the editorial work has been particularly large by reason of the fact that publication previously delayed is being brought up to date as rapidly as possible. The greater part of the editorial supervision, proof reading, etc, has been performed by the Ethnologist in Charge; but since the beginning of the present fiscal year a considerable portion has been assigned to Mr Hodge and has been conducted by him in an eminently satisfactory manner. The rearrangement of the library is now practically completed and the work of bringing up the exchange list is also chiefly done, so that the administration of the library is largely reduced. Valuable accessions are constantly made to the Bureau library in the form of exchanges and through gifts.

Mr James Mooney spent the month in the field in Oklahoma, collecting additional data relating chiefly to the Kiowa, but in part to the Comanche and Apache, with whom he has already

been in contact. The purpose of the information is in part to enable him to complete his work on the synonymy of these Indians, and in part to yield material for two projected monographs on the Kiowa. Meantime his bulletin on the "Siouan Tribes of the East" has been passing through the printer's hands; the page proofs have been revised, and with the exception of an index the work is now complete.

Work in mythology—Mr Frank Hamilton Cushing devoted the month to the revision of his paper entitled "Outlines of Zuñi Creation Myths," forming part of the Thirteenth Annual Report, and to the preparation of an introduction, editorial inspection of the matter having indicated the need of such supplementary material.

Mrs Matilda C. Stevenson continued writing her monograph on the Zuñi, giving especial attention to the arrangement of illustrations, the execution of which is now largely completed.

Work in linguistics—Mr J. Owen Dorsey was occupied for a part of the month in the rearrangement of linguistic manuscripts in the fireproof vaults in the office of the Bureau. Many of these manuscripts are unique; a large proportion represent the work of the regular collaborators of the Bureau, but some have been derived from other sources by exchange and by donation through the interest in this subject developed early in the history of the Bureau. The material is of great scientific value, and it is deemed important that it should be arranged in readily accessible form in the fireproof vaults and that it should be suitably catalogued. Mr Dorsey also aided in cataloguing the large collection of photographs, his long continued acquaintance with the Indians of the Siouan family proving especially useful in this connection. A part of the month was devoted to the preparation of material for the synonymy of the Siouan stock.

Dr Albert S. Gatschet was occupied in the extraction of lexic and grammatic elements from his Shawnee manuscripts, in which satisfactory progress was made. He also examined a number of linguistic manuscripts submitted to the Bureau by correspondents, commonly with a view to publication.

Mr J. N. B. Hewitt was occupied during most of the month in study of the suggested similarities between the Maya and

Malay languages collected by Dr Thomas. This work is laborious, but has been executed with patience and skill in an eminently satisfactory manner. A part of the month was occupied in the making and arrangement of translations from Pierre Margry in such manner as to permit easy reference.

Work in bibliography—Mr Pilling continued the collection and arrangement of bibliographic material relating to the language of North America south of the United States. His progress has been quite satisfactory. A large amount of material has been brought together and the final arrangement under authors' names has been carried to the end of the letter G. The work has been but slightly retarded by the condition of Mr Pilling's health, thanks to his untiring energy and perseverance.

Publications—The Eleventh Annual Report was received during the month and the distribution is well under way; a few copies of the twelfth have been received and distribution will be commenced at once; all of the matter of the Thirteenth Annual Report (excepting the introductory portion and the index) is in type and nearly all in pages, about half being already stereotyped. The material for the fourteenth and fifteenth reports is practically ready for the press; but through the failure of the Richardson bill to pass, there is no legal authority for publication.

Volume IX of the Contributions to North American Ethnology has been printed in the Congressional edition and a few copies of the Bureau edition have already been received, and the preparation of circulars for distribution has been commenced.

Dr Boas' large bulletin on "Chinook Texts" is all in pages and nearly all stereotyped. Mr Mooney's bulletin on the "Siouan Tribes of the East" is all in pages except the index. Professor Holmes' bulletin on "An Aboriginal Workshop in Indian Territory" is daily expected from the bindery. The bulletin on the archeology of the James and Potomac valleys, by Gerard Fowke, to which reference has already been made, actually reached the Government Printing Office only during this month; but composition was at once taken up and the entire matter is now in pages, and proofs of the illustrations have

been received. A "List of Publications" of the Bureau was prepared by Mr Hodge and was transmitted during the month for publication as a bulletin, and this matter also has been composed and the proofs have been revised.

It is a painful duty to record the tragic death in New York on September 6 of Dr Hilborne T. Cresson, a correspondent and informal collaborator of the Bureau. For some years Dr Cresson had been engaged in researches on the western Gulf coast, chiefly in Guatemala and Mexico, under the provision of the De Laincel fund, the Director being one of the board of advisers with respect to the expenditure of the fund. Although no formal appointment was ever given to Dr Cresson, he was supplied with stationery by the Bureau and in other ways was afforded facilities, particularly during his journeys. For some months previous to his death he had been engaged in the elaboration of his observations with a view to publication.

OPERATIONS DURING SEPTEMBER

The work of the month has been conducted chiefly in the office, the field work being limited to the closing of Mr Cosmos Mindeleff's surveys and researches in the pueblo region of the southwest and the initiation of explorations among the Papago Indians in southern Arizona and about the Mexican frontier. These operations have been placed under the conduct of the Ethnologist in Charge, who, with his assistant, Mr William Dinwiddie, left Washington for Gallup, New Mexico, September 19.

Work in sign language—As during previous months, Colonel Garrick Mallery was engaged in the preparation of his report on Indian sign langnage. Attention was given to the completion of illustrative matter for the final report, the preparation of the text of which is being successfully carried forward.

Work in Indian hieroglyphics—Dr Cyrus Thomas returned during September to his work on the day and month symbols and names of the Central American calendar, having completed his excursion into a collateral line of research for the purpose of reviewing the data of the relationship of the Maya

to the Malay. Dr Thomas finds that this collateral study has facilitated ascertainment of the methods used among savage and semicivilized peoples in forming mythologic names, and, through the knowledge of the deity symbols thus acquired, has aided in the interpretation of the Maya glyphs. The study of the Malay calendar system and astronomical concepts has likewise served to elucidate those of Central America.

Work in eastern archeology—Mr William Dinwiddie continued during the earlier part of the month the elaboration of a report on the steatite quarry at Clifton, Virginia, explored during the closing months of the fiscal year 1893–94.

Work in western archeology—Mr Cosmos Mindeleff suspended early in the month his field operations in the pueblo country of southwestern United States. The details connected with the closing of the work, the completing of accounts, and the arrangements necessary for disposing of his field outfit and equipment consumed the greater part of the month. Toward the end of September he started for Washington. The scientific results of the explorations and surveys just concluded by Mr Mindeleff are indicated in a general way in the summary report of the operations of the Bureau of American Ethnology for the last fiscal year

Work in synonymy—Mr J. Owen Dorsey devoted the greater part of the month to the advancement of the preparation of the material for the Siouan synonymy—a work which he reports will require before its completion several months of close application. During the days of the month on which Mr Dorsey was not thus engaged, he was occupied in the examination and classification of the Siouan photographs in the possession of the Bureau.

Mr F. W. Hodge was unable during the month to devote much attention to the work of tribal synonymy, his time and energy being expended in the conduct of the editorial work of the Bureau, in the management of the library, and, during the absence in the field of the Ethnologist in Charge, in the administrative duties of the office.

During the opening days of the month Mr James Mooney finished the work on which he had been engaged in Oklahoma

during August—the collection of additional material relating to the Kiowa, Comanche, and Apache tribes for use in completing the synonymy of these Indians, and for the purpose also of acquiring data for two projected monographs on the Kiowa.

Work in mythology—Mr Frank Hamilton Cushing was engaged during the earlier portion of September in the completion of an introduction to his paper entitled "Outlines of Zuñi Creation Myths," which forms a part of the Thirteenth Annual Report of the Bureau.

Mrs Matilda C. Stevenson continued during the month the preparation of text and the arrangement of illustrative material for her forthcoming monograph on the Zuñi Indians of western New Mexico.

Work in linguistics—As during previous months, Dr Albert S. Gatschet was occupied in the work of extracting his field notes on Shawnee for the completion of a projected grammar of the language. Some attention was given also to the arrangement of material for a Shawnee lexicon and an ethnographic sketch. Dr Gatschet also continued his comparative studies of the phonetics, grammar, etymology, and syntaxis of all the Algonquian languages. The Algonquian comparative vocabulary was materially increased during the month.

Mr J. N. B. Hewitt was engaged throughout the month in analyzing the conceptual and other stems composing the comparative lists of Maya and Malayan vocables submitted for investigation by Dr Thomas. Progress in this work is necessarily slow by reason of the imperfect character of our knowledge of Maya word formation, the untrustworthiness of some of the authorities, and the necessity of translating the matter used from the original French and Spanish. Mr Hewitt also gave attention to the preparation of a complete catalog by author, unit, and category of the manuscripts in the archives of the Bureau.

Work in bibliography—Mr James C. Pilling reports that during September he continued work on the preparation of material to form the basis of a series of bibliographies of the languages of the southern portion of North America. Good

progress has been made and the results have proved more satisfactory than Mr Pilling had previously been led to anticipate. The final arrangement under authors' names has been advanced to the end of the letter M.

Publications—The Twelfth Annual Report of the Bureau was received during the month, and its distribution, along with that of the Eleventh Annual Report, received during August, was commenced at once. Nearly all of the matter of the Thirteenth Annual Report is now in pages.

Volume IX of the Contributions to North American Ethnology, comprising "Dakota Grammar, Texts and Ethnography," by S. R. Riggs, edited by Mr J. Owen Dorsey, was received from the Government Printing Office, and its distribution begun.

Dr Boas' bulletin on "Chinook Texts" is now in pages, has been ordered stereotyped, and the plate proofs are expected daily. Mr Mooney's bulletin on the "Siouan Tribes of the East" is complete with the exception of the index, and has been ordered cast. The bulletin by Professor W. H. Holmes, entitled "An Ancient Quarry in Indian Territory," will be received from the folding room within a day or two. The bulletin on "Archeologic Investigations in James and Potomac Valleys," by Gerard Fowke, has passed through the stage of first revise. The bulletin by Mr Hodge, a "List of the Publications of the Bureau of Ethnology," transmitted for publication during last month, has now been stereotyped and ordered printed.

OPERATIONS DURING OCTOBER

Field work—The only work done in the field during the month consisted of the operations among the Papago Indians of southern Arizona and contiguous portions of Mexico, begun in September by Mr W J McGee, the Ethnologist in Charge, and his assistant, Mr William Dinwiddie. Having outfitted at Tucson, Arizona, for an extended trip through Papagueria (the land of the Papago), the party worked southward through the valleys of Santa Cruz and San Luis, visiting all of the Papago villages as well as nearly all of the Mexican

villages in which the Papago temporarily reside, acquiring information as to other villages and settlements, studying their arts (of which a considerable portion are primitive), and collecting typical specimens of their art products. The international boundary having been crossed temporarily, two days were spent at Poso Verde, an exclusively Papago village on the headwaters of Rio Altar, and detailed studies of the various ethnologic features were made, attention being given also to collecting art products and procuring photographs showing art operations. The significant fact was developed that all the Papago of Poso Verde repudiate accultural religion and profess only aboriginal beliefs, though the influence of early Spanish contact survives in a form of baptism, sometimes by visiting priests, though generally (and preferably) by their own shamans in more primitive fashion. Recrossing the frontier at Nogales, the party made researches in about a dozen other Papago villages. The bands are so far discrete that the acquisition of information is difficult and demands extensive journeying. It is thought that the information already collected is satisfactory in quantity, and it is opined that, the first reconnoissance being completed, the later work and collections will prove still more valuable.

Work in Indian hieroglyphics—Dr Cyrus Thomas continued during October his work on the day and month symbols and names of the Central American calendar, and his study of the interpretation and significance of the Maya glyphs was carried forward with success. Dr Thomas was occupied also during the month in preparing for the press Mr C. C. Royce's historical atlas of Indian land cessions and the accompanying explanatory schedules.

Work in archeology—Mr Cosmos Mindeleff began during the month the preparation of reports on his field operations in the pueblo country of southwestern United States, covering the period from July, 1893, to September, 1894, at which date the field work was closed and Mr Mindeleff returned to the office. It is expected that these reports will be completed by the end of the present calendar year.

Incidental attention was given to the prehistoric works in Papagueria by Mr McGee during the month, an extensive

ruin near Poso Verde having been studied and an ancient village near Arivaca, Arizona, probably older than the ruins of Rio Salado, having been surveyed.

Work in synonymy—Mr J. Owen Dorsey reports that his work during the month was divided between the examination of his manuscripts and books in the library in order to collect materials for Siouan sociology, arts, cults, etc, and the preparation of a chapter on Siouan sociology. This has been incorporated in the fifteenth report.

The entire time and attention of Mr Hodge were devoted during the month to administrative duties in the office, including the conduct of the library and the editorial work of the Bureau.

Work in mythology—Mr Frank Hamilton Cushing returned to the office on the 25th of September after visiting the American Museum of Natural History in New York City for the purpose of studying the collections made by Dr Carl Lumholtz at the Casas Grandes ruins in Chihuahua, now deposited in this museum. These collections are of value in that they illustrate the character and extent of the ancient intercourse between the pueblos of New Mexico and Arizona and the Nahuatlan pueblos of central and southern Mexico; and it is apparent that careful study of this material will develop a knowledge of the origin and evolution of the ancient culture of the Mexican tribes and the cognate families of southern United States. Mr Cushing also made examination of the collections in New York gathered in the coastal and montaña regions of Peru by Mr Adolph F. Bandelier, and the collections in Philadelphia procured in the Chira valley of northern Peru by Mr Samuel Matthewson Scott, the materials in both of which give evidence of an industrial art in metal work closely resembling, but far surpassing, that which Mr Cushing has experimentally worked out as having existed among the mound-building Indians of this country. Later in the month Mr Cushing made arrangements in pursuance of which Mr Charles D. Hazzard, of Minneapolis, Minnesota, has agreed to deposit in the National Museum for two years his collections comprising all the cliff-dweller exhibits displayed at the World's Columbian Exposition. During the month Mr Cushing devoted

much attention to experimentally developing and reproducing the various stages of ancient American textile and metal-working arts.

Mrs Matilda C. Stevenson continued during October the work of preparing the texts and arranging the illustrative material for her forthcoming monograph on the Zuñi Indians.

Work in linguistics—The researches of Dr Albert S. Gatschet during the month were confined to detailed study of the Shawnee language and to comparative study of all the Algonquian dialects. As previously reported, this work has been in progress for some time and satisfactory advance toward completion has been made.

Mr J. N. B. Hewitt was engaged during the greater part of the month in completing and perfecting the etymologic analysis of the Malay and Maya words in the comparison submitted by Dr Thomas. From the fact that all the authorities on the Malay and Maya languages, with the exception of Marsden's Malayan works, are in French and Spanish, translations thereby being rendered necessary, and from the laborious nature of the study itself, this work has been found quite tedious; Mr Hewitt, however, has carried it forward in a satisfactory manner. A part of the month was devoted to the study of Dr Lumholtz' Tubari material.

Work in bibliography—Mr James C. Pilling continued during the earlier part of the month the compilation of material relating to the languages of Mexico, Central America, and Yucatan. The later half of October was devoted to examination of the current periodical literature of scientific societies and of sale catalogs for fresh material relating to North American languages for insertion in his new catalog.

Work in sign language—As announced to the Secretary in a previous communication, Colonel Garrick Mallery, by whom the researches in sign language were being conducted, died October 24. In the death of Colonel Mallery the Bureau of American Ethnology suffered the loss of a brilliant investigator.

Publication—The plate proofs of the bulletin on "Chinook Texts," by Dr Boas, were received during the month and returned to the Public Printer approved, subject to corrections; the necessary changes have not as yet been made.

Professor W. H. Holmes' bulletin, entitled "An Ancient Quarry in Indian Territory," was received from the folding room during the month. The bulletin on "Archeologic Investigations in James and Potomac Valleys," by Gerard Fowke, has reached the second-revise stage.

The distribution of the eleventh and twelfth annual reports and of volume IX of Contributions to North American Ethnology was continued during the month.

OPERATIONS DURING NOVEMBER

The field work of the month was confined to that of a single party conducted by Mr W J McGee, Ethnologist in Charge, in Arizona and contiguous portions of Sonora. The beginning of the month found the party in the vicinity of several Papago villages and rancherias (the largest being that of Querobabi) in Sonora. The expedition proceeded thence southward to the neighborhood of Hermosillo, where other rancherias of the Papago Indians were found and where additional information was obtained concerning the southernmost representatives of the tribe midway between that point and the Gulf coast at Guaymas. On completing the study of the Papago Indians in this vicinity, it was found expedient to extend the journey into the territory of the Seri Indians, doubtless the most primitive tribe remaining on the North American continent, and one of the most primitive ever found on the Western Hemisphere. The territory of these Indians comprises Tiburon island, in the Gulf of California, together with a few small neighboring islands, as well as an ill-defined area of some thousand square miles on the mainland of Sonora. The party, with two or three temporary additions, proceeded to Rancho de San Francisco de Costa Rica on the border of the Seri territory, and near there they were fortunate in finding some sixty members of the tribe, comprising a quarter or a third of the survivors of this interesting people. Their habits and modes of life, with their arts and art products, were studied with such fullness as the circumstances permitted, and a vocabulary of some four hundred words was collected for the purpose of determining the ethnic relations of the tribe. A series of some

fifty photographs were obtained, showing portraits, groups, habitations, costumes, face painting, and art processes; and a collection of utensils, weapons, clothing, and other articles, embracing a large part of the property of the rancheria, was procured for the Museum. Various additional items of information were obtained from these Indians, including a confession of the wanton murder of two out of a party of four Americans who visited their territory a few months previously.

From the coast the expedition returned to Hermosillo and proceeded northwestward through a difficult and for the most part uninhabited country, in such manner as to find, definitely locate, and study Papago rancherias, concerning which only vague information was otherwise obtainable. In general, the Papago Indians maintain essential independence of whites and Mexicans in their industries and beliefs, this being especially true on the Arizona side of the boundary, where many of the villages are essentially aboriginal except in so far as the aboriginal character has been modified by the indirect acquirement of horses, cattle, burros, a few field and garden plants, and articles and styles of costumery. The villagers seldom see white men, and live in primitive habitations in a largely primitive way. This is not true of the Yaqui and most other Indians of Mexico, who have become dependent on white men and largely (in spite of the law relating to peons) reduced to a condition of peonage. In only one locality were the Papago Indians found to be laborers like their aboriginal neighbors, namely, at Cienega, where several families work in the "dry placers," extracting gold under a system which practically renders them peons. In a few other cases, but only rarely and almost altogether on the Mexican side of the boundary, the Papago have entered the employ of white men or Mexicans of mixed blood. Passing the settlements of Poso Noriego, where the Indians occasionally work for wages, and Cienega, where they are peons, the expedition proceeded to the ancient Papago settlement of Caborca on the lower part of Altar river, and thence up the valley to Altar, stopping at the considerable Papago settlement at Pitiquito. At Altar information was gained concerning the single Papago family

residing there, as well as concerning the neighboring settlements, this being the heart of the original Papagueria. The party proceeded thence northward, crossing the boundary midway between Sasabi and Sonoita, examining the Papago villages of Miguel, Fresnal, Tucson, and Coyote, together with a number of the temporary agricultural villages known as temporales, in southern Arizona. It was the intention to cross the boundary farther westward and examine the westernmost settlements of these Indians at Sonoita, Santo Domingo, and Quitobaquito, in Sonora, and Quijotoa and other points in Arizona; but the animals were exhausted in consequence of the difficulties of travel in this arid region, and moreover opportunities arose for obtaining exceptionally definite information concerning these outlying villages. Accordingly, the expedition turned toward the point of starting and reached the Papago subagency at San Xavier, near Tucson, on November 22. Some days were spent at this point in making additional collections, packing, etc, when the party was disbanded, Mr McGee reaching the city November 29 and Mr Dinwiddie a few days later. Considerable collections were made from the Papago Indians at Poso Noriega, Caborca, Pitiquito, Miguel, Ventana, Fresnal, Tucson (Indian), and Coyote, as well as at San Xavier. The Fresnal collection was particularly instructive, including among other articles a family fetich, which was obtained only with great difficulty.

Work in Indian hieroglyphics—During the earlier part of the month Dr Thomas resumed his researches relating to the day and month symbols and names of the Maya calendar, while the remainder of the month was occupied in examining and revising the manuscript and maps of Mr C. C. Royce's historical work on Indian treaties and in making such comparisons and additions as were found necessary in preparing the matter for the press. This work was well advanced during the month.

Work in archeology—Mr Cosmos Mindeleff spent the earlier part of the month in completing the accounts growing out of his field work and in overseeing the development of his photographic negatives and the making of prints thereof. The work in both lines was completed, and toward the close of the

month he commenced the preparation of a report on the cliff ruins of Canyon de Chelly and made satisfactory progress in the preparation of this report, with the accompanying illustrations.

The party in Sonora and Arizona continued to make incidental studies of prehistoric works in several localities. It was found that most of the valleys sufficiently watered for cultivation were cultivated by means of irrigation during prehistoric times, the prehistoric fields being generally more extensive than those of modern times, while the early acequias rise well up the valley sides, overlooking those of the present population. Many groups of mounds, each evidently representing the ruins of a domicile, were found in connection with the ancient irrigation works, and in several cases these domiciliary mounds were grouped about much larger elevations, strewn with fragments of painted pottery (unlike that manufactured by the modern Indians), apparently representing the ruins of temples or other dominating structures, these larger mounds being sometimes inclosed by embankments. In some instances these were found near what were once evidently populous valleys, entrenched mountains, or isolated buttes protected by barricades of stone in such manner as to indicate that they were temporarily used as places of retreat. No habitations, storehouses, or reservoirs were found on these barricaded mountains, this condition, with others, indicating the temporary character of the fortifications. It is of interest to note, among the archeologic results of the expedition, that the Papago Indians are found to use stone mortars and hammerstones which they do not themselves manufacture, but find in the neighborhood of ancient and perhaps prehistoric settlements, and turn to their own uses.

Work in synonymy—Mr J. Owen Dorsey spent the month in the preparation of an introduction to the synonymy of the Siouan tribes, completing the chapter on sociology and taking up a chapter on language.

Mr F. W. Hodge gave some time to the extension and arrangement of material for this compilation, though the greater portion of his time was occupied in administrative and editorial work.

Work in mythology—Mrs Matilda C. Stevenson continued the preparation of her report on Zuñi myths, making satisfactory progress in the work.

Mr Frank Hamilton Cushing was occupied in completing a general introduction to the memoir on "Zuñi Creation Myths," now going into type as a part of the Thirteenth Annual Report. In this introduction Mr Cushing presents a summary history of the Zuñi Indians, including an account of their country and their mode of life, a sketch of their pristine history as determined from researches, myths, etc, and an account and review of their relations to white men since the discovery. The body of the paper comprises a detailed account of the elaborate mythology of this people pertaining to creation and the cosmos.

Work in linguistics—Dr Albert S. Gatschet continued the preparation of his comparative Algonquian dictionary, at the same time carrying forward the Shawnee dictionary and grammar. In connection with the latter work, some data were accumulated for a historical and ethnographic sketch of the Shawnee Indians.

Mr J. N. B. Hewitt devoted the greater portion of the month to transcribing Tarahumari material from the alphabet used by Dr Carl Lumholtz to that of the Bureau, in order to facilitate reference and future publication. He also continued the study of the supposed relationship between the Maya and the Malay languages. In addition, some days were devoted to cataloguing the manuscript material in the vaults of the Bureau, of which a large part is linguistic.

Work in bibliography—Mr James C. Pilling continued his researches relating to the literature of the American Indians, chiefly those of Mexico and Central America. He has now carried his bibliography of the languages of these countries into the letter P. During the month he has accumulated an exceptionally large number of new titles.

Publication—During November the manuscript of the indexes to three of the bulletins of the Bureau ("Chinook Texts," "Siouan Tribes of the East," and "Archeologic Investigations in James and Potomac Valleys") was sent to the Public Printer, and the matter was subsequently returned to this office, the

indexes reaching the second-revise stage during the month. The bulletin entitled "List of the Publications of the Bureau of Ethnology," by Mr Hodge, was received from the bindery and its distribution partially made.

OPERATIONS DURING DECEMBER

No field work of consequence was performed during this month. During the earlier days of December Mr William Dinwiddie finished packing the Seri and Papago collection already described, and returned to the city. On the 25th of the month Mr James Mooney left the office for field work in Oklahoma.

Work in Indian hieroglyphics—Dr Cyrus Thomas divided his time between the continuation of researches relating to the Mexican codices and of the revision for the press of the monograph on "Indian Land Cessions," by C. C. Royce. A bulletin on the day and month names of the Maya calendar has been for some time substantially complete, but it has been deemed better to withhold publication pending the completion of collateral researches on which Dr Thomas has recently been engaged. The revision of the text of the Royce monograph was practically completed during the month, but the voluminous series of maps require further work.

Work in archeology—Mr Cosmos Mindeleff spent the month in the preparation of a report on the "Cliff Ruins of Canyon de Chelly." This report comprises the results of researches in that district during the last year and a half, during which period a large number of surveys were made, yielding some 80 plans and maps, and in addition a considerable series of photographs were made. The elaboration of this voluminous material in the form of a report has progressed satisfactorily.

Work in synonymy—Mr F. W. Hodge was able to devote a considerable part of the month to the revision of cards pertaining to several southwestern stocks and to the collection of additional material. A part of his time, however, was devoted to editorial work.

Mr J. Owen Dorsey continued the preparation of the introduction to the Siouan synonymy, bringing this work nearly

to completion. A part of the month was devoted to the continuation of the Winnebago-English dictionary, in connection with special work on language by the Director.

Mr McGee revised the cards of the Piman synonymy relating to the Papago Indians. Through the observations during the recent expedition into the Papago country, he was able to estimate approximately the Papago population, to locate and describe a considerable number of new villages and rancherias, and to correct and extend information concerning villages and rancherias reported by earlier observers.

Work in mythology—Mr Frank Hamilton Cushing continued writing and revising the introduction to the memoir on "Zuñi Creation Myths," nearly all of the manuscript being turned in for editorial revision before the end of the month.

Mrs Matilda C. Stevenson continued the preparation of a report on Zuñi with special reference to the beliefs of that people and the customs and institutions connected therewith.

Work in linguistics—Dr Albert S. Gatschet continued researches relating to the Shawnee language, and at the same time carried forward comparative study of the grammatic elements of the Algonquian languages, making good progress in both of these interrelated studies.

Mr J. N. B. Hewitt continued transcribing the Tarahumari vocabulary collected by Dr Carl Lumholtz, and in addition continued the preparation of a card index catalog to the contents of the fireproof vaults in which the rich body of manuscripts collected by the Bureau are stored.

A part of Mr Dorsey's energies were devoted to linguistic work, as already noted.

Work in bibliography—Mr James C. Pilling continued the collection and arrangement of titles of works referring to the primitive languages of Mexico, including Yucatan, as well as Central America and the extreme southern portion of the United States. His alphabetically arranged cards pertaining to these languages have now reached the letter R. A part of the month was devoted to a systematic study of the writings of Padre de Olmos, whose work was of special importance in its bearings on North American linguistics.

Publication—During the month the plate proofs of the bulletin by Dr Boas on "Chinook Texts" were revised and returned, and printing ordered; plate proofs of Mr Mooney's bulletin, "Siouan Tribes of the East," were received, revised, and returned, and printing ordered, the last proofs of the index also being revised; and the last proofs of Mr Fowke's bulletin, "Archeologic Investigations in James and Potomac Valleys," including the index, were revised and returned, and printing was ordered. A large number of illustrations for the Thirteenth Annual Report have been engraved, and proofs thereof were revised and returned. The distribution of several recently issued reports and bulletins was continued throughout the month.

OPERATIONS DURING JANUARY

The only field work conducted during the month was that of Mr James Mooney, who continued investigations among the Kiowa and associated tribes of Oklahoma.

Work in Indian hieroglyphics—Dr Cyrus Thomas was engaged during part of the month in researches relating to the interpretation of Mexican codices and calendar systems. The larger portion of his time, however, was spent in the revision of the monograph on "Indian Land Cessions," by C. C. Royce. The revision of the schedule of treaties has practically been completed, and the preparation of an introductory to the work was carried forward with success.

Work in archeology—Mr Cosmos Mindeleff continued work during January on his report on the "Cliff Ruins of Canyon de Chelly," making satisfactory progress therein. It is expected that the text of this report, which embraces the results of Mr Mindeleff's field operations from July, 1893, to September, 1894, in the pueblo country of southwestern United States, will very shortly be completed.

Work in synonymy—Mr F. W. Hodge was engaged during the month in extracting the synonyms (mostly misprints) from Donaldson's "Moqui Pueblo Indians of Arizona" for use in the Indian Cyclopedia and Synonymy. The closing portion of the month was devoted to compiling, from the recent writings

of Dr J. Walter Fewkes, descriptions of the Tusayan gentes and phratries. Much of Mr Hodge's time was given also to directing the transmission of Bureau publications and to the editorial work of the office.

Mr James Mooney, who spent the month in the field, was occupied chiefly in collecting and arranging material relating to a calendar history of the Kiowa.

An attack of typhoid fever confined Reverend J. Owen Dorsey to his home during the month, and deprived the Bureau of his valuable services.

Work in mythology—Mr Frank Hamilton Cushing completed during January the text of the introduction to his memoir on "Zuñi Creation Myths," which forms part of the Thirteenth Annual Report of the Bureau.

Mrs Matilda C. Stevenson's report on the Zuñi people, their customs and beliefs, was during the month carried forward toward completion.

Work in linguistics—Dr Albert S. Gatschet reports that there was no alteration in the plan of his study of the Algonquian languages, his researches pursuing the same lines as during previous months, and his work of extracting material for his Shawnee as well as for his comparative Algonquian vocabulary proceeding as heretofore.

During the earlier part of the month Mr Hewitt was engaged in translating from the Spanish original the grammar of the Tarahumari, by Fray Miguel Tellechea, in furtherance of work on the Tubari material of Dr Lumholtz. The remainder of the month was given to the study of the data relating to the relationship of the Seri to the Yuman family, the results of the examination (which, however, is not yet completed) yielding no sufficient evidence for the inclusion of the Seri in the Yuman stock.

Work in bibliography—Mr James C. Pilling continued the preparation of the bibliography of the languages of Mexico and the southern portion of the United States, and his work, which during the last ten days of the month was prosecuted in the Astor, Lenox, and Historical Society libraries of New York city, was marked with gratifying progress.

Collections—In addition to administrative work, Mr McGee was occupied in the elaboration of notes concerning the Seri and Papago Indians, made during a recent expedition. Early in the month the body of the collections made among these Indians was received and unpacked in the National Museum. The various articles were labeled, chiefly by Mr William Dinwiddie, and the bird skins and other perishable objects were treated to insure preservation. In this and other work in connection with the collections, courtesies and facilities were freely extended by Professor Goode, Dr Mason, and other Museum officials, and it is a pleasure to acknowledge the assistance thereby received. The final preparation and arrangement of the collection was not undertaken because of the urgent need for developing the large number of photographic negatives procured during the expedition; it was feared that these negatives would deteriorate with long keeping, and it was deemed better to have Mr Dinwiddie devote his energies first to the development of the pictures; moreover, the photographs will be required for use in the final arrangement of the collections for exhibition in the museum. Some six hundred photographs were taken, illustrating all phases of arts, industries, habitations, modes of life, and costumes of both Papago and Seri Indians, and several somatologic pictures representing both tribes were obtained. It is believed that these photographs will greatly enhance the interest and value of the collection.

OPERATIONS DURING FEBRUARY AND MARCH

Field work was practically suspended, the only operations in this direction being those conducted by Mr James Mooney in connection with a local study made on the ground among the Kiowa Indians for the purpose of completing certain reports.

Work in Indian hieroglyphics—Although the greater portion of his energies were devoted to another subject, Dr Cyrus Thomas spent part of the two months in continuing his researches relating to the Mexican codices and other inscriptions. He has now completed the preparation of another bulletin on this subject, which would have been sent to press

before now, save that through the exigencies of Congressional action the provision for publication of bulletins is temporarily suspended.

During the two months, Dr Thomas continued the revision of the monograph on "Indian Land Cessions," by C. C. Royce, and made substantial progress in the preparation of an introduction to the work. It is the purpose so to arrange this monograph that it will become a standard work of reference concerning the land cessions between the Indians and the Federal Government. In this respect the monograph was substantially complete when it left the hands of the compiler, Mr C. C. Royce, but it has been thought desirable to incorporate an introductory chapter, setting forth as fully as practicable the colonial land treaties with the Indians, as well as the general policy of treating with the aborigines throughout the history of our country in both colonial and post-Revolutionary times; and to render the exposition still more comprehensive, the policies of the Spanish and French governments with respect to Indian rights and treaties in the territory now belonging to the United States are discussed, illustrated by typical laws and treaties, and summarized. The preparation of the introduction has required extended research among early records and publications. The work is now well advanced.

Work in archeology—During February and March Mr Cosmos Mindeleff continued the preparation of a report on the "Cliff Ruins of Canyon de Chelly, Arizona." A preliminary draft of the text was brought to substantial completion, and the later portion of March was spent chiefly in the preparation of illustrations. This report, representing the results of some fifteen months continued field work, will unquestionably form a rich contribution to the knowledge of southwestern archeology. As indicated by the text and illustrations already completed, the surveys were conducted with great detail, and a large body of facts pertaining to the rapidly disappearing works of the prehistoric peoples of this region has been put together in a systematic way. It is thought that these surveys and the reports based thereon will render Canyon de Chelly classic ground for the archeologist.

Work in synonymy—During February and a part of March Mr F. W. Hodge was occupied largely in the distribution of publications and in editorial work on papers designed for future reports. Besides proof revision, he edited an important paper on the Coronado expedition to the tribes of New Mexico and the great plains in 1540–1542, by George Parker Winship. This document, comprising a large body of unpublished material, is rich in records pertaining to the early history of the southwestern Indian tribes and to their condition when first seen by white men. It is incorporated in the Fourteenth Annual Report.

A considerable part of Mr Hodge's energies were devoted to the continuation of the Synonymy or Cyclopedia of Indian tribes, and satisfactory progress was made in the work. Portions of the material collateral to the main subject have been brought together in the form of papers designed for publication either in the reports of the Bureau or in more general scientific journals.

Mr James Mooney remained in the field, engaged chiefly in arranging his material relating to the Kiowa calendar history for publication, and in collecting additional material required for the exhaustive presentation of the subject.

Work in mythology—Mr Frank Hamilton Cushing continued his study of the "Zuñi Creation Myths" with a view to the incorporation of important additional matter in his introduction to a series of these myths now in press as part of the Thirteenth Annual Report. His researches concerning arrow games were resumed during March.

Mrs Matilda C. Stevenson continued the preparation of her elaborate report on the Zuñi Indians and their ceremonials. Progress was made in the preparation both of texts and illustrations.

Work in linguistics—Early in the month of February the Bureau suffered an irreparable loss in the death of Reverend J. Owen Dorsey. On examining his official papers, it was found that his work relating to the Indian Cyclopedia (or Synonymy) was so arranged that the voluminous material is available for reference or publication. It was found also that nearly all his

linguistic material is recorded in permanent and readily accessible form. Few students leave the records of their work in so satisfactory a condition; yet Mr Dorsey's acquaintance with the multitudinous details of the Siouan and other languages, and his comprehensive grasp of their relations among each other and to language in general, can never be acquired by others, and consequently the material loses a part of its value. Among other papers there was found a memoir on "Siouan Sociology," so nearly completed that it has been prepared for the press and incorporated in the Fifteenth Annual Report.

Dr Albert S. Gatschet continued his researches concerning the Shawnee dialect and his comparative arrangement of the Algonquian languages, and satisfactory progress was made in both directions during the two months. In connection with the more general study, he also made substantial progress in classifying the data concerning the Peoria language.

Mr J. N. B. Hewitt continued the transliteration into the Bureau alphabet of the linguistic material collected among the Tubari of Mexico by Dr Lumholtz, with a view to publication by the Bureau as a bulletin. The transliteration of the vocabulary was brought nearly to completion; the English-Tubari part was finished, and nearly 500 entries in the Tubari-English portion have been made.

Work in bibliography—Mr James C. Pilling continued the collection and arrangement of titles of works relating to the aboriginal languages of Mexico and contiguous portions of the United States. His visit to the Astor, Lenox, and Historical Society libraries of New York yielded a considerable body of new material, and the carding of this material and the arrangement for printing were carried forward as rapidly as circumstances permitted. During March Mr Pilling's work was in some measure interrupted by ill health.

Collections—Mr McGee was occupied largely in administrative work, but continued the elaboration of material relating to the Papago and Seri Indians. Mr William Dinwiddie was employed chiefly in developing negatives and making prints therefrom, the photographs representing the work of the recent expedition to the Papago-Seri country.

Anthropologic classification—In organizing and conducting the work of the Bureau of American Ethnology, it is constantly recognized that classification is at the same time an end and a means of scientific research. Through research the characters and relations of men and their institutions, of ideas and the modes of expressing them, of beliefs and their attendant ceremonials are ascertained and thereby classification is rendered possible, and this classification represents a summary of that knowledge which it is the purpose of research to gain; but with each step in classification the horizon of the investigator is extended and new relations of successively higher order are conceived, whereby the research is made easier and fuller of meaning.

When the operations of the Bureau began fifteen years ago, the work was organized in accordance with the classification of the science of anthropology representing the sum of the knowledge of the subject then extant; but it has been constantly recognized that the classification necessarily adopted at that time was tentative only, and it has been the policy to extend the classification with each notable addition to knowledge. For several years the Director has been prevented by administrative duties from coordinating so fully as seemed desirable the more general results of the researches carried forward under his supervision. He is now engaged in this work of coordination for the double purpose of increasing the efficiency of the Bureau and of raising the science to a higher plane. This work of coordination is yielding a classification of anthropology, and incidentally of cognate branches of knowledge; and the bearings of this classification on the work of the Bureau and on anthropology generally seem to be such as to warrant somewhat full publication in the reports of the Bureau. During the last two months a considerable amount of material has been prepared for this purpose.

Publication—By reason of the pressure of Congressional work in the Government Printing Office, the completion of certain documents well advanced in press has been delayed and no publications have been issued. The Thirteenth Annual Report is nearly all in type. Three important bulletins by

Messrs Boas, Fowke, and Mooney, respectively, are stereotyped, and the Foreman of Printing gives assurance that the printing will soon be taken up. Authority for the publication of the fourteenth, fifteenth, and subsequent reports was conferred by the passage, on January 12, 1895, of the general printing bill; a number of important memoirs have been brought together for publication therein, and the reports will be forwarded for printing at an early day.

OPERATIONS DURING APRIL

Field work has been limited to that of Mr James Mooney, who remains on the Kiowa reservation, Oklahoma, collecting material for and preparing the manuscript of a special report on Kiowa heraldry.

Work in Indian hieroglyphics—The interruption of Dr Thomas' work on this subject, in order that he might prepare an introduction for and edit the monograph on "Indian Land Cessions," by C. C. Royce, has been continued. Dr Thomas has made satisfactory progress in the collection of historical material for this introduction and in the preparation of the manuscript for printing.

Work in archeology—Mr Cosmos Mindeleff was occupied throughout the month in the preparation of a report on the "Cliff Ruins of Canyon de Chelly." The text was completed and the report has been submitted by the author for publication. The accompanying illustrative material was also worked up and made ready for the preparation of final drawings for reproduction, and the execution of the drawings is under way.

The completion of Mr Mindeleff's report rounds out one of the lines of archeologic research in the southwest which has been in progress for some years; and with the transmission of the report Mr Mindeleff's connection with the Bureau terminates.

Work in synonymy—The work of collecting and arranging material for the Indian tribal dictionary has remained in charge of Mr F. W. Hodge, and, as heretofore, his researches have yielded valuable collateral data. During the month he has formulated several important conclusions based on

comparison of various little-known early records, partly in manuscript, with the traditions of different southwestern tribes. Among these are the following:

1. The creation and migration tradition of the Navaho is notably accurate, especially as regards the chronologic sequence of events; and the advent of the ancestors of the Navaho in San Juan valley about the end of the fifteenth century is thereby established.

2. The original Navaho were probably cliff dwellers, and the tribe appears not to be a ramification of the Apache, as hitherto supposed; it is probable that the Apache were already in the San Juan region as a numerous group of small tribes at the advent of the Athapascoid Navaho.

3. The Apache were probably confined to limited areas in western New Mexico in the middle of the sixteenth century.

4. The Navaho were composite even before the eighteenth century, when the tribe embodied remnants of the Athapascan, Tanoan, Keresan, Zuñian, Shoshonean, Yuman, with perhaps other native stocks, in addition to a slight admixture of Aryan. The accession of at least one foreign clan produced a marked effect on the Navaho language.

5. By reason of limited numbers, the Navaho and Apache did not molest the Pueblo tribes prior to the seventeenth century.

6. The Navaho acquired flocks and herds through the Pueblos soon after 1542, whereby their mode of life was changed.

7. The defensive character of at least the western pueblos anterior to 1680 was due apparently to intertribal broils.

In general Mr Hodge's researches indicate that with proper care Indian tradition may frequently be used in corroboration of historical records. In addition to his researches relating to southwestern tribes, Mr Hodge was occupied during a part of the month in revising proofs, indexing the Thirteenth Annual Report, and transmitting the Bureau publications.

Work in mythology—Mrs Matilda C. Stevenson continued the arrangement of material for her report on the Zuñi Indians, giving especial attention to the myths and ceremonials of the tribe.

Mr Frank Hamilton Cushing continued the revision of proofs for his "Zuñi Creation Myths," at the same time pursuing collateral researches relating to the development of arts, institutions, and beliefs among the southwestern Indians.

Work in linguistics—Dr Albert S. Gatschet continued his comparative work on the Algonquian dialects, at the same time pushing forward his special arrangement and classification of the elements of the Shawnee language, making satisfactory progress on both lines.

Mr J. N. B. Hewitt continued the laborious transliteration of the Tubari material of Mexico collected by Mr Carl Lumholtz. Extended comparisons were also made between the Tubari and other southwestern languages for the purpose of fixing more definitely the linguistic affinities of the nearly extinct Tubari tribe.

Work in bibliography—During the earlier portion of the month, Mr James C. Pilling continued the preparation of the bibliography of the aboriginal languages of Mexico, bringing this work to substantial completion. With the completion of this portion of the bibliography, the immense task of cataloguing the literature of the aboriginal languages of North America, on which Mr Pilling has been engaged several years, is substantially finished. For some years after the institution of the Bureau in 1879, Mr Pilling performed in a most acceptable manner the duties of chief clerk. While performing these duties he gradually assumed the bibliographic work, which grew until it absorbed a considerable part of his energies. In 1891 he retired from the position of chief clerk and thenceforward devoted his time wholly to the bibliography. Meantime his health began to fail, and he has now for some years been a sufferer from locomotor ataxia; but, despite this physical burden, his bibliographic work was continued with remarkable fortitude until the end for which he had labored so many years was practically attained. During some months past the malady has progressed apace; it has recently assumed new complications, and during the closing part of the month it compelled discontinuance from active work and his retirement from the Bureau.

Collections—Mr McGee has been occupied chiefly in administrative and editorial work. Mr William Dinwiddie continued and completed the development of negatives taken during the recent expedition to the Papago-Seri country, and is resuming the labeling, arrangement, etc, of the collection.

Anthropologic classification—The Director has been occupied in elaborating the classification of the science of man, which forms the foundation for the work of the Bureau. In this work the voluminous collection of manuscripts, notes, and other material collected by the Bureau since its institution is constantly used, and is found of great value.

Publication—The composition of the Thirteenth Annual Report is nearly completed, a few pages remaining for revision. During the month the bulletin by Dr Franz Boas, entitled "Chinook Texts," was delivered from the bindery and distribution was begun. The bulletin by Mr Mooney on the "Siouan Tribes of the East," is reported in the bindery, and that by Mr Fowke on "Archeologic Investigations in James and Potomac Valleys" is reported on the press.

OPERATIONS DURING MAY

As hitherto, for some months field work has been limited; Mr James Mooney remains in the field collecting material for and preparing a report on Kiowa heraldry; and Dr J. Walter Fewkes repaired to New Mexico during the closing days of the month for the purpose of making collections among the ruins of ancient pueblos.

Work in Indian hieroglyphics—The interruption of Dr Cyrus Thomas' researches relating to the codices and other inscriptions of southwestern United States and Mexico is continued. During the greater part of the month he has been employed in the preparation of the introduction to the monograph by C. C. Royce on "Indian Land Cessions."

Work in archeology—The execution of the drawings designed to illustrate the report by Mr Cosmos Mindeleff on the cliff ruins of Canyon de Chelly has been carried forward, though somewhat slowly by reason of pressure toward the completion of illustrations for other reports now being made ready for the press.

Work on the Indian cyclopedia—Even before the institution of the Bureau of American Ethnology, ethnologists generally recognized the need of definite information concerning the names, habitats, and relations of the aboriginal tribes, and several students had made essays toward the collection of such information in form for publication. A vast number of items containing such information may be found scattered through the literature commonly designated by the term "Americana." The literature is voluminous and many of the published works are rare, while a considerable part of the material exists only in unique manuscripts. When the Bureau was organized, one of the lines of work projected was the collection of such information not only by research among the Indians themselves, but by examination of the literature and manuscripts. The bibliographic work undertaken in the Bureau and so long successfully carried forward by Mr Pilling was designed largely as a means to this end. In addition, all of the collaborators of the Bureau were instructed to obtain and record general facts pertaining to the tribes with whom they came in contact; and most of the collaborators of the Bureau have been employed from time to time in collecting and arranging the material. At first it was planned to arrange the material in the form of a synonymy, recording the accepted names in connection with the families or stocks, together with the great number of synonyms which have found their way into use, orally and in print. Early experience in the work indicated the desirability of incorporating collateral information in connection with the names, and for some time this plan was pursued; still later, as the material accumulated and came into constant use in manuscript form, it was found convenient to include Indian names other than tribal, and still further to increase the scope of the work. Meantime the name Synonymy was retained. When a definite plan was formulated for publication in a series of stock monographs, it was found that the designation employed for some years was inadequate and misleading, and the term "Dictionary" came into use orally; but this term, too, seems too narrow, and it is thought best to arrange the material for printing in bulletin

form as family monographs, under the designation "Cyclopedia of the American Indians."

During the month Mr Hodge has continued the arrangement of material for the Cyclopedia, giving his energies chiefly to southwestern families; and satisfactory progress has been made. Meantime he was occupied in part in editorial work on the Thirteenth Annual Report. At the same time he continued oversight of the work in the library, including the distribution of documents.

Work in mythology—Mr Frank Hamilton Cushing continued the revision of proofs for his "Zuñi Creation Myths" during the month. Toward the end of the month his office work was interrupted by illness, and under the advice of a physician he is spending a vacation in Florida. His journey thither brought him in contact with the Seminole Indians, and among them he is collecting material and information of high ethnic value.

Mrs Matilda C. Stevenson continued the preparation of her report on the Zuñi Indians. This elaborate memoir is approaching completion.

Work in linguistics—Dr Albert S. Gatschet has continued the collection and arrangement of lexic and grammatic material pertaining to the Algonquian family. A part of the month was spent in comparative study of this material and of the work by Trumbull and Müller on the Algonquian verb.

Mr J. N. B. Hewitt continued the transliteration and comparison of the Tubari language collected by Dr Carl Lumholtz. The task of preparing this material for publication is great, but is now nearly completed; when ready for printing, the monograph will be a unique and invaluable record of a once numerous tribe now nearly extinct

Work on the Menomini Indians—Dr Walter J. Hoffman has at different times while connected with the Bureau visited the Menomini and other Indian tribes of northern Wisconsin and western Michigan and thereby amassed a considerable body of information relating to these Indians. An important part of this material, during the last fiscal year, when Dr Hoffman was in full connection with the Bureau, was incorporated in a monograph on the Menomini. At present Dr Hoffman has an

honorary connection with the Bureau, and for some months has been occupied in part in the rearrangement and revision of this monograph for printing. During the month the work was completed, and the monograph has been incorporated in the Fourteenth Annual Report.

Collections—The Papago and Seri collections have received attention throughout the month. The photographs collected during the expedition last autumn have been arranged and labeled for use by Mr McGee in the preparation of a report on the results of the expedition. Meantime Mr Dinwiddie has been employed in labeling and arranging the collection in the National Museum. During the latter half of the month this work was carried forward in connection with the arrangements for the exposition at Atlanta, where it is planned to exhibit a part of the collection.

Toward the end of the month Dr J. Walter Fewkes, of Boston, was by the Secretary commissioned to make collections for the enrichment of the Museum from among the prehistoric pueblo ruins of the southwest; and on May 25 he began the work of preparing for the trip, and a day or two later left for Arizona. Early reports will doubtless be received direct from the field.

Work on the Kiowa Indians—Mr Mooney reports the successful prosecution of his work during May in the preparation of models of heraldic tipis, shields, and sacred and military insignia of the Kiowa and Apache tribes in Oklahoma, and reports also satisfactory progress in the preparation of his paper on Kiowa heraldry. In the camp circle of the Kiowa, and the tribes united with them, there were about 200 tipis, 50 of which were decorated with heraldic devices, while all were accompanied by shields with insignia or other paraphernalia belonging to the family, order, or individual represented by the tipi. Study of this elaborate camp circle, with its heraldic and other devices, has thrown much light on the social organization of these tribes.

Anthropologic classification—The Director has continued the preparation of a classification of anthropology for the double purpose of systemizing the material already collected in the

Bureau and now in preparation for publication, and for establishing a foundation for further researches.

Publication—The composition of the Thirteenth Annual Report is completed and nearly all of the matter is stereotyped. The closing pages of the body of the volume are now in the form of third revise.

The Fourteenth Annual Report was on May 27 made ready for transmission for publication. The report comprises two accompanying papers. The first of these is the monograph on the Menomini Indians by Dr W. J. Hoffman, already mentioned. It contains a historical sketch of the tribe, with special reference to early contact and treaties with the whites, together with a full account of the habits, customs, and beliefs characterizing the tribe. It contains also a brief vocabulary. The second of the accompanying papers is by Mr George Parker Winship, of Harvard University, entitled "The Coronado Expedition in 1540–1542." Coronado was the first white man to visit a large area in southwestern and central United States and northwestern Mexico, and the accounts of his chronicler, Pedro de Castañeda, of the tribes have always, in so far as they have been accessible, been found singularly accurate and trustworthy. Unfortunately, Castañeda's record has not hitherto been accessible to English-reading students, and the existing French translation contains essential errors. Mr Winship has with great labor prepared careful translations of the Castañeda and other documents, prefaced by an historical account which greatly enhances the value of the work, and this it is now a pleasure to offer students in connection with the Fourteenth Annual Report of the Bureau. The paper is illustrated by reproductions of early maps required to elucidate the texts, and also by photographs of pueblos, etc, made by officers of the Bureau, also introduced for the purpose of rendering the original account intelligible and vivid. These illustrations were furnished by Mr Hodge, who has otherwise aided Mr Winship in the preparation of his memoir.

Mr McGee has been occupied in part in arranging and editing the material for the Fifteenth Annual Report, which is now nearly ready for transmission.

During the month, the bulletins by Mr Mooney on the "Siouan Tribes of the East," and by Mr Fowke on "Archeologic Investigations in James and Potomac Valleys" were received from the Government Printing Office, and the transmission of the part of the edition pertaining to the domestic exchange of these bulletins and of that by Dr Franz Boas on "Chinook Texts" has been completed, while the distribution of the foreign portion of the exchange is well advanced.

OPERATIONS DURING JUNE

Field work has been limited to (1) that connected with collecting objective material for the National Museum by Dr J. Walter Fewkes in Arizona, and (2) that of Mr James Mooney, who remains in the field in Oklahoma, collecting material for a report on Kiowa heraldry and gathering objective material for the Museum.

Work in Indian hieroglyphics—As during the preceding months, Dr Cyrus Thomas has been employed chiefly in the preparation of an introduction to the monograph by Mr C. C. Royce on "Indian Land Cessions," and thereby his special researches on the codices and other inscriptions of the southwestern portion of the continent have been held largely in abeyance. In the preparation of this introduction and in the revision of the manuscript with a view to facilitating composition, he has made satisfactory progress. An essential part of the monograph is a series of maps showing graphically, with the highest attainable accuracy, the tracts covered by the various land treaties. These maps were drawn originally on tracings from the state maps of the General Land Office, so far as these extend, and on maps of corresponding scale elsewhere; but, in publishing, it is necessary to reduce the scale materially in order that the map plates may be no larger than of single-page or double-page size. In many cases the tracts transferred by treaty are of such extent as easily to be represented on the reduced maps; in other cases the areas are so small that proper representation requires a scale as large or even larger than that of the original. Accordingly, it has been deemed desirable to supplement the state maps by local detail

maps whenever required; and Dr Thomas is having these detail maps drawn. This work, as well as the rearrangement of certain portions of the text for printing, is well under way.

Work in archeology—The execution of the drawings to illustrate the memoir by Mr Cosmos Mindeleff on the aboriginal works of Canyon de Chelly is making satisfactory progress under the supervision of Mr DeLancey W. Gill.

Work on the Indian cyclopedia—During a part of the month Mr F. W. Hodge continued the preparation of material for the cyclopedia, and a number of new cards were added. A portion of his time was given to a rearrangement of the library and the installation of a new tier of book cases; also to bringing up the records of the library for the year and the completion of the distribution of later publications. Some time was also given to editorial work, chiefly the index of the Thirteenth Annual Report.

Work in mythology—Mrs Matilda C. Stevenson continued the revision of notes and the final writing of manuscript for her report on Zuñi ceremonials. This elaborate report has been in preparation several months. In view of the great number and interest of the ceremonials and the significant nature of the beliefs of the Zuñi Indians, it is thought desirable to spare no pains in making it as nearly exhaustive as possible, and thus all details of ceremonial and belief are receiving special attention, necessarily at considerable expense in time.

Mr Frank Hamilton Cushing completed the revision of the proofs of his "Zuñi Creation Myths," forming a part of the Thirteenth Annual Report. His work on this subject was somewhat retarded by illness, and on completing his task he repaired to Florida, nominally on vacation, but actually in the hope of collecting information relating to the shell mounds of the Florida coast and keys. This hope was fully realized, and in addition he was able to obtain much information of importance respecting the Seminole Indians. In studying the shell mounds, he made a number of measurements and surveys indicating the vast number and extent of these artificial structures along certain portions of the coast, especially between Tampa and Cape Sable. He ascertained that some of the

keys skirting the coast have been greatly modified and even extended artificially, the shell accumulations with accompanying débris in some instances covering many acres, and in certain cases reaching a depth of several yards. Locally the shell accumulations have evidently been made with definite purpose, and have been carried up symmetrically into large mounds comparable in dimensions with the Indian mounds of the interior. In his studies of the Seminole Indians, Mr Cushing found that they display certain characteristics which appear to ally them with the Caribs. One of these is the custom of living in pile dwellings under certain circumstances; and pile dwellings now occupied, as well as some structures now abandoned, and others of considerable antiquity were examined. Some of these pile dwellings appeared to Mr Cushing to stand in definite relation to certain of the shell mounds, particularly those of definite form, and through this relation he is able to gain some insight into the origin and development of mound building among the American aborigines, this insight being in part due to his intimate acquaintance with Indian modes of thought.

He finds that, in the interests of convenience, a pile dwelling is located over the waters of a sound, perhaps some yards from the shore; but while yet occupied by the builders, the domestic débris (chiefly refuse shells) accumulates until it rises above the water level, when the building appears to stand on posts in a low mound. Now the Indian is curiously persistent in habit, so that the men of the second generation who chance not to be constrained otherwise by environment, regard the pile-mound structure as normal and proper and worthy of imitation. As time passes, the accumulation beneath and about the original house goes on until the piles are buried and the habitation stands on a mound, when in turn this type of structure comes to be regarded as the normal and proper type among the younger and more active members of the tribe just beginning house construction. Through this natural series of changes in type of habitation and in concert, and through the myth-constrained social organization of the people, there is a tendency to the development, under favorable circumstances,

of a custom of the erection of mounds as sites for habitations and for the council house of the clan or tribe, the sites being either separate mounds or single large mounds, according to circumstances. Thus the study of the living Seminole Indians and of the shell mounds in the same vicinity, in connection with his previous studies of Indian mythology, suggests to Mr Cushing a possible origin for a custom of mound building at one time so prevalent among the North American Indians.

Work in linguistics—Dr A. S. Gatschet continued researches concerning and comparison among the Algonquian languages. Especial attention was given to Peoria linguistic material, which he continued to elaborate. The studies and comparisons of this material indicate that it is sufficient for publication, so far as the vocabulary is concerned, though the comparisons with other Algonquian dialects and with the dialects of other Indian families indicate that further material must be obtained before the grammar can be perfected. In connection with this special work, the preparation of the comparative Algonquian grammar and lexicon was carried forward.

Mr J. N. B. Hewitt continued the transliteration of the Tubari linguistic material collected by Dr Carl Lumholtz, making satisfactory progress; at the same time he made comparative researches bearing on the affinities of this tongue, which is now practically extinct.

Collections—Mr William Dinwiddie continued the labeling of the Papago and Seri collections made by the Ethnologist in Charge during the fiscal year, the preparation of the labels and manuscript being practically completed At the same time he carried to essential completion the arrangement of this collection for display at the Atlanta Exposition, being temporarily transferred to the Museum for this purpose.

A part of the display is designed immediately for use at Atlanta, but eventually for the elucidation of the collections arranged in the Museum. It has been planned to prepare three life-size figures in characteristic costume, with especial attention to somatologic details. The modeling of these figures was entrusted to Mr U. S. J. Dunbar. Two of the figures represent Papago women, in ordinary occupation; the third a Seri hunter, with bow and quiver of arrows.

Dr J. Walter Fewkes, who was during May commissioned to make collections from the cliff and other prehistoric ruins in Arizona, continued operations with a fair measure of success. He outfitted at Prescott about the beginning of June, and proceeded eastward across the headwaters of Rio Verde, through a region little known archeologically. He was able to locate a number of cliff houses and to make fairly satisfactory collections therefrom. In the "Red Rock country," some miles from Liveoak creek, he was so fortunate as to find two large and extensive cliff ruins hitherto unknown to archeologists and apparently not despoiled by white men. Toward the end of the month he arrived at Flagstaff and arranged for further work, chiefly in the direction of excavation, during July.

Mr James Mooney, who remains in the field engaged in researches pertaining to the customs and especially to the surprisingly well-developed system of heraldry among the Kiowa Indians, made a considerable collection for the Museum, comprising articles of costumery, appliances used in medicine, and a large series of tipi models.

Work among the Kiowa Indians—In connection with making collections, Mr Mooney's researches concerning the heraldry, ceremonials, customs, and legends among the Kiowa Indians were carried forward throughout the month, and he reports satisfactory progress in the preparation of a memoir on the system of heraldry found among these Indians.

Anthropologic classification—The Director continued researches relating to the classification of the American Indians. Various systems of classification of mankind have been devised in different civilized countries. In general, the classifications hitherto formulated are empiric and rest on a limited number of attributes. Accordingly, the systems are more or less discrepant and more or less unsatisfactory. During the sixteen years since the institution of the Bureau of American Ethnology the science of ethnology has made great progress in this and other countries; particularly in this country the attributes of primitive races have been recorded with care, with a constant view to their bearing on the relations of mankind in general. Accordingly, the records now in possession of the Bureau pertaining to the attributes and relations of races are

exceptionally full and comprehensive. Examination of the records indicates that the empiric classification, or the classification based on a limited number of attributes, is unsatisfactory, and it seems desirable to formulate a classification so comprehensive as to apply at the same time to all of the aborigines of the Western Hemisphere and to be equally applicable to mankind in general. The researches of the Director concerning classific attributes are accordingly extended; already results of great utility to the Bureau have flowed from the work, and there is a promise of still more useful results in the early future.

Sociology—In addition to administrative and editorial work, Mr McGee has been employed in researches relating to the sociology of the American Indians. During the month he examined and revised for publication the memoir on "Siouan Sociology," prepared by the late J. Owen Dorsey.

Publication—The Thirteenth Annual Report is stereotyped, with the exception of the index and the brief administrative report forming the first division of the document.

The Fourteenth Annual Report, transmitted for printing during May, is in the hands of the Public Printer, and the illustrations have been examined with a view to making contracts for reproduction.

The Fifteenth Annual Report was transmitted for printing on June 14. It comprises a memoir on "Stone Implements," as developed among the aborigines of the Potomac-Chesapeake region, by W. H. Holmes; a memoir on the "Siouan Indians," by W J McGee; another on "Siouan Sociology," by the late J. Owen Dorsey, and a memoir on "Tusayan Katcinas," by J. Walter Fewkes. In his discussion of stone art, Professor Holmes, while describing the form and distribution of the art products, devotes especial attention to the primitive quarries and modes of quarrying, and to the processes of manufacture of the various articles of stone used by the Indians. Thus he is able to set forth the history of each class of art products in a remarkably satisfactory manner. It is believed that through this method of study of stone art in sequence, as well as by single stage, American archeology has been raised to a higher

plane. Thus this memoir is regarded as of exceptional interest and value. The other memoirs also are regarded as important contributions to the branches of the science to which they relate.

Change in appropriation—Under a decision of the Comptroller of the Treasury, the appropriation for the fiscal year, heretofore regarded as continuous under the terms of the law, is interpreted as not continuous and lapsing with the fiscal year.

SUMMARY REPORT

CLASSIFICATION OF THE OPERATIONS

As set forth in the introductory paragraphs of this report, the operations in the Bureau of American Ethnology relate to the essentially human or demotic characteristics of the peoples under investigation, i. e., the American aborigines. These qualities, as displayed by mankind in general, constitute the object-matter of five sciences, namely, (1) *esthetology*, (2) *technology*, (3) *sociology*, (4) *philology*, and (5) *sophiology*. So far as practicable, all of these sciences have been cultivated with equal assiduity, although administrative conditions have led to the arrangement of the work along special lines, in such manner as to produce the best results from the work of the collaborators.

EXPLORATION

During the earlier portion of the fiscal year Mr Cosmos Mindeleff was occupied in extending and completing his explorations and surveys in southwestern United States. During the field season of 1894 his operations were largely confined to Canyon de Chelly in northeastern Arizona, but his reconnoissances and surveys were extended into contiguous territory. During July and the earlier part of August he examined San Juan valley and there obtained information of much interest. In its topography and general geographic conditions this region appears to have been well adapted to the needs of the ancient pueblo builders, and it affords examples of nearly all the types of aboriginal villages now known, together with other types

and many variants which have not been surveyed elsewhere. The examination and comparative study of these relics throw much light on the development of art in architecture by the people of the pueblos. In other directions, too, the observations add materially to knowledge of the habits and customs of the aborigines. Mr Mindeleff's researches during the season, in connection with his surveys during the last fiscal year, have covered a large territory and will permit archeologic mapping of value; even the negative results are useful as indicating the territory barren of aboriginal works.

Early in September Mr Mindeleff brought his field operations to a close. The greater part of the month was spent in completing his accounts and disposing of his field outfit and equipment. Toward the end of the month he repaired to Washington to begin the preparation of a final report on his surveys of the preceding fifteen months.

The most extended exploratory work of the year was that of an expedition through the country of the Papago and Seri Indians of Arizona and Sonora (Mexico), conducted by Mr McGee. The expedition was fitted out in Tucson about the middle of October. Mr William Dinwiddie accompanied the expedition as photographer, and the party included also a Papago Indian interpreter and from time to time Indians or Mexican guides and interpreters. Leaving Tucson, the party proceeded to and through San Luis valley, and temporarily crossed the frontier at Sasabe to the Papago Indian village of Poso Verde. Here the leader and interpreter remained several days, collecting information concerning the distribution of the Papago villages and rancherias, while Mr Dinwiddie was sent back to Tucson to make necessary changes in outfit. A few days later the party reassembled at Arivaca, Arizona, where surveys were made of extended prehistoric works. Thence the expedition moved to the frontier at Nogales, where after some delay authority for extending the operations on Mexican soil was courteously accorded, in response to representations made through the local officials to the federal officers of the Republic of Mexico. Leaving Nogales, the party proceeded southward, visiting several villages formerly occupied by

Papago Indians but now abandoned, and finding rancherias occupied by representatives of the tribe at various points.

The rancherias near Querobabi were found especially interesting, and a number of valuable photographs were taken. While a primary purpose of the expedition was the collection of objective material for preservation in the United States National Museum, little such material was collected during this part of the trip, (1) because of the desire to comply with the spirit of the Mexican law relating to the removal of antiquities, and (2) because of the difficulty of transporting objects over hundreds of miles of frequently trackless territory. Other Papago rancherias were found as far southward as Hermosillo, and information was obtained concerning settlements midway between that city and Guaymas. During the journey from Tucson to Hermosillo the eastern and southern limits of the Papago territory were determined, many of the characteristics of the tribe were ascertained, and their arts were studied in such manner as to facilitate subsequent collection of typical objects.

After two or three days' delay in Hermosillo, due to the difficulty of obtaining authority to enter the territory of the warlike Seri Indians, the expedition proceeded toward the coast adjacent to Tiburon island. During this part of the trip the expedition had the pleasure and advantage of the company of Señor Pascual Encinas, an aged Mexican, formerly of great energy and courage, who had done much to extend white settlement into the Seri country, and whose services in this direction have received abundant recognition on the part of the state and the Republic. Piloted by Señor Encinas and Señor Alvemar-Leon, the expedition entered the borders of the Seri territory and was so fortunate as to find a temporary rancheria occupied by some sixty individuals of the tribe. During the ensuing week their habits and customs were studied, a part of their vocabulary was recorded, and a number of individual and group photographs were made. In addition, typical articles of costumery, weapons, utensils, etc, were collected and some information was gained concerning the ethnic characteristics of the tribe. The Indians were found

quite primitive, probably more primitive and savage than any other tribe remaining on the North American continent. Most of their food is eaten raw, they have no domestic animals save dogs, they are totally without agriculture, and their industrial arts are few and rude. By reason of their warlike character, little has hitherto been known concerning the tribe; the photographs made by the expedition are the first known to have been made of the Seri Indians.

Returning to Hermosillo early in November, the party set out on the return journey, so shaping the course as to determine the southwestern limits of Papago occupancy. Interesting Papago rancherias were found at Poso Noriega and at Cienega, and in both localities photographs and a few small objects of special interest were obtained. Between these points several prehistoric ruins were discovered, and a few examples of the singular prehistoric works called by the Mexicans *las trincheras* (entrenched mountains) were observed. Passing northward, the ancient Papago town of Caborca was visited and additional photographs were made. A remarkable example of entrenched mountain near this point received careful attention. From Caborca the expedition proceeded to Pitiquito, where opportunity was again presented for collecting Papago material, and thence to Altar. The limit of the time fixed for the journey on leaving Tucson being nearly at hand, and the stock having suffered greatly from the rigors of travel through one of the most arid of regions, it was found necessary here to abandon the plan for extending the studies to Santo Domingo and Quitobaquito, the westernmost settlements of the Papago; and the expedition proceeded directly toward the boundary near Sierra de la Union, between Rancho de San Joaquin, in Sonora, and Rancho Ventano, in Arizona.

There are several Papago rancherias near the last-named rancho, and in these collections and photographs were made. The party then proceeded to Fresnal, the principal Indian village in Papagueria, where the team was loaded with objects obtained from the Indians. Later, Tucson (Indian) was visited, and afterward a stop was made at the Papago village of Coyote. Between the last-named points and at Coyote

prehistoric villages and other antiquities of much interest were noted, and a small collection of fragmentary prehistoric pottery, etc, was made. On November 25 the expedition returned to Tucson, and immediately on disbanding the Ethnologist in Charge repaired to Washington, Mr Dinwiddie remaining for a few days for the purpose of completing collections on the Papago reservation at San Xavier. The expedition resulted in a considerable collection, representing the arts and industries of the partially acculturized Papago Indians, whose arts have been hitherto but meagerly represented in the National Museum or other repositories of scientific material; in the first noteworthy collection of objective material ever made among the Seri Indians; in some 500 photographs of the Seri and Papago Indians and their surroundings, this collection being of special interest since the Seri Indians have not hitherto been photographed, while few pictures of the Papago have hitherto been taken; and in a considerable body of ethnic material appertaining to both tribes.

Toward the close of the calendar year Dr Franz Boas, who had visited British Columbia for the purpose of continuing researches relating to the native languages under the auspices of the British Association for the Advancement of Science, communicated with the Bureau, suggesting that he be given authority and means for visiting the Kathlamet Indians of the lower Columbia region for the purpose of collecting texts representing their language and mythology. After correspondence, he was authorized to carry out his plan of operations, the material collected to be conveyed to the Bureau for a stipulated sum. Dr Boas devoted several weeks to the work, and after his return to eastern United States prepared the material for publication. It was not quite complete at the end of the fiscal year, but was soon afterward transmitted and found to be a valuable addition to knowledge concerning the northwestern tribes.

About the end of December Mr James Mooney proceeded to the field in Indian Territory for the purpose of making researches concerning the Kiowa calendar and the Kiowa heraldic system. He remained dwelling among the Kiowa Indians until

after the close of the fiscal year. Among the Kiowa, as among other plains Indians, and indeed among all of the aboriginal tribes, there is a widespread symbolism by which the arts are influenced and guided. Under this symbolism tents, shields, arrows, pipes, musical instruments, robes, and other articles are inscribed, painted, or otherwise marked with designs. In many cases these designs possess decorative value, and by superficial students they are commonly supposed to be used simply for decoration; but study of the Indian character and motive shows that the design is not primarily decorative (though the germ of decoration may be found therein), but symbolic and fraught with meaning to those who understand the symbolism. This primitive symbolism is found to be developed and differentiated in various ways among different tribes of the American aborigines; among the Kiowa Indians it is differentiated into a crude yet highly significant system of heraldry, which throws much light on the medieval heraldry of Europe; and in another direction it is differentiated into a system of winter counts or calendars, forming at the same time a chronologic system and an historical record which, although crude and imperfect, are of great interest. Among the same Indians the system of symbolism has been differentiated in a third direction, though one nearly parallel with the first, in such manner as to form a symbolic record of social organization and relation, this part of the record being largely painted on the dressed-skin tents. Thus the symbolism of the Kiowa Indians elucidates the origin of several arts brought to perfection only among much more highly cultivated people; it represents a crude heraldry, a budding chronology, a nascent decorative art, and the germ of writing.

Although remaining in the field, Mr Mooney made considerable progress during the fiscal year in the preparation of a memoir on the Kiowa calendar, though the manuscript will require revision as his studies approach maturity, after his return to the office.

ARCHEOLOGY

Professor W. H. Holmes, who retired from the Bureau before the beginning of the fiscal year, left two reports nearly

ready for publication. One of these relates to the stone art of the aborigines as exemplified and elucidated by the relics found in and near the tidewater region adjacent to Chesapeake bay; the second to the fictile art as represented by collections from eastern United States, especially from the mounds. While both reports were substantially complete as to letterpress, they were incomplete as to illustrations, and the preparation of requisite illustrations was carried forward under the supervision of the Ethnologist in Charge and Mr DeLancey W. Gill. During July a number of photographs were made, for incorporation in the memoir on stone art, by Mr Cushing and Mr William Dinwiddie. When the illustrations were completed, the memoir was incorporated in the Fifteenth Annual Report of the Bureau, which was sent to press during the year.

During portions of July and August Mr Dinwiddie was engaged in the elaboration of notes on a remarkable steatite quarry near Clifton, Virginia, and in the transfer of the collections to the National Museum. The Clifton quarry is one of the largest of the aboriginal excavations of soapstone thus far found in eastern United States, and is noteworthy for the depth of the cutting and the large amount of fragmentary and other material representing the processes of primitive quarrymen. Mr Dinwiddie's work on this material was interrupted when he joined the expedition into the Papago country, and his report has not been completed.

Mr Cosmos Mindeleff, who returned from the field about the end of September, was occupied during the greater part of October in closing his accounts and in other duties connected with the termination of long-continued field operations. Afterward he began the preparation of a report on his surveys and researches. During November, December, and January the material was reduced to the form of a memoir on the cliff ruins of Canyon de Chelly. In February a preliminary draft of the text was brought to substantial completion, and the later portion of March was spent chiefly in the preparation of illustrations. During March and April the text was revised and rewritten, and toward the end of the latter month it was submitted for publication. The preparation of the final drawings

for the illustrations was also substantially completed, and in June the memoir was assigned for publication in the Sixteenth Annual Report of the Bureau.

Mr Mindeleff's surveys, recorded in his report on Canyon de Chelly, were both extended and detailed, and have yielded a large body of especially trustworthy data relating to this interesting portion of the continent. In a large number of cases he made diagrams showing the ground plans of structures, based on careful measurements, and these plans were connected in plats, which were in turn combined into maps. Whenever practicable, the plans were supplemented by drawings in elevation and perspective, and by photographs; and the photographic and other illustrations present vividly the characteristics of the region examined and the conditions under which the ancient cliff dwellers lived, moved, worshiped their mysteries, defended themselves against enemies, died, and were buried. Many explorations have been made in the southwestern region, and many students have collected material relating to the peculiarly intelligent aborigines of this district; but none of the explorations have been more thorough, none of the records more faithful, than that just completed by Mr Cosmos Mindeleff, and it is thought that his report will make Canyon de Chelly classic ground for the archeologist.

Although conducted primarily for other purposes, the expedition directed by Mr McGee resulted in a number of interesting archeologic discoveries. Among these may be mentioned, (1) "Las Trincheras," a class of temporary fortifications about isolated buttes or peaks near habitable valleys, forming a new archeologic type for this country; (2) a considerable number of prehistoric village sites, irrigation works, etc, in a region heretofore supposed to be barren archeologically; (3) extended village sites, each dominated by one or more ceremonial or other grand structures, sometimes accompanied by inclosures suggesting the domestication of animals; and (4) great acequias, carried farther up the valley sides than the present irrigation works, indicating more complete conquest of the waters during prehistoric times than at present. The archeologic material collected during the expedition has

not been prepared for extended publication, but is withheld for further research in the same region.

Although the collections in the National Museum made by members of the Bureau in former years for the purpose of illustrating the life of the pueblo tribes since the Spanish advent is exceedingly rich, comparatively few objects representative of the prehistoric arts of these interesting people have been collected. Opportunity having at last been afforded for excavation among the remains of the ancient cliff dwellings and pueblo peoples of the southwest, the Bureau was fortunate enough to enlist the services of the late director of the Hemenway Expedition, Dr J. Walter Fewkes, the results of whose researches among the Hopi Indians of Tusayan, Arizona, are well known. Dr Fewkes proceeded, late in May, to the unfrequented locality known as the Red Rock country, southwest of Flagstaff, Arizona, where he had the good fortune to find a group of extensive cliff ruins hitherto unknown to archeologists and not despoiled by white men. Excavation was prosecuted among these aboriginal remains during June with considerable success, and a number of excellent photographs were made. At the end of the month Dr Fewkes returned to Flagstaff with a view of reoutfitting for a thorough exploration of some of the extensive and presumably rich ruins in the Tusayan country of the northeastern part of the territory.

DESCRIPTIVE ETHNOLOGY

Ever since the discovery of the American continent explorers have been impressed by the characteristics of the aborigines, and many of them have recorded their observations and impressions in reports, letters, diaries, and treatises, and great numbers of these records have been printed and published to the world. In this way a great body of literature, sometimes styled "Americana," has been produced. A large part of this body of literature relates partly or wholly to the American Indians. Usually the records were based on superficial observation and frequently they are vitiated by misapprehension and hasty generalization. Nevertheless much of the literature represents actual observation of the Indians while yet they

retained primitive characteristics. Thus, although the early records are diverse in value, the body of the literature of this class contains a large store of information concerning the physical characteristics, mental attributes, habits, customs, arts, beliefs, and institutions of the native Americans. Moreover, research concerning primitive peoples has shown that the ideas of the savage and barbarous peoples are expressed in the nomenclature much more fully and significantly than are those of cultured people, so that the records of personal and geographic names are often of great utility as indices to the intellectual characteristics, customs, and institutions of the Indian tribes. Information of this class abounds in America. Thus there is a large store of information in the publications of the early and later travelers in America, but the literature is so vast and widely scattered that the information is nearly inaccessible to students.

Even before the institution of the Bureau of American Ethnology, ethnologists generally recognized the need of systematic information concerning the aboriginal tribes, and several students had made essays toward the collection of such information from the voluminous literature, either for personal use or for publication. When the Bureau was organized, one of the lines of work projected was the compilation of such information from the published literature and from manuscripts, the compilation being guided and corrected and the material enriched by concurrent research among the Indians themselves. The bibliographic work undertaken in the Bureau, and so long successfully carried forward by Mr Pilling, was designed largely as a means to this end. In addition, all of the collaborators of the Bureau were instructed, and many correspondents were urged, to obtain and record general facts pertaining to the tribes with which they came in contact; and most of the collaborators of the Bureau have been employed from time to time in collating the material gathered in this way. Anterior to the institution of the Bureau, most of the students engaged in systemizing the ethnologic data, arranged the material alphabetically on cards or in books, generally under tribal and other proper names—this was the method pursued by Dr O. T. Mason, of the Smithsonian Institution,

who was engaged in the work before the institution of the Bureau—and essentially the same plan was pursued by Mr James Mooney during his earlier researches before he became connected with the Bureau.

Under this method of assembling the data, it frequently happened that the records were brief and incomplete and that the terms under which the entries were made were variable, so that much care and thought were necessarily devoted to the ascertainment of synonymy. As the work progressed with the Bureau the studies continued, and the Director and collaborators engaged in the compilation came to speak of the work as a "Synonymy" of the Indian tribes. As the material continued to accumulate, and particularly as the more extended and more accurate information gained by actual researches among the Indians was incorporated, it was found that the synonymy proper diminished relatively, while the body of general information became greatly expanded. Now that the records have so increased as to fill many thousands of cards, it is found that the work forms a great cyclopedia relating to the Indian tribes, which even in manuscript form is of large and constantly increasing utility. With the development of a plan for publication, as set forth in the last report, the inadequacy of the original name for the work came to be appreciated, and during the present year it has been decided to begin the issue of the work in a series of bulletins corresponding with the aboriginal linguistic stocks, under the designation "Cyclopedia of the American Indians."

Throughout the fiscal year Mr F. W. Hodge has had charge of the work on the cyclopedia, and during most of the time he has been engaged in preparing for publication the records pertaining to several southwestern stocks. Early in the year Mr J. Owen Dorsey also contributed to the work, and during July, August, and September Mr James Mooney was occupied partly in extending the portion of the cyclopedia relating to the eastern tribes of the Siouan family. Several bulletins are practically ready for the press, and, save for the conditions growing out of the modification of the law governing the public printing, some of these would have been sent to the press before the close of the year.

In 1883 Mr C. C. Royce was employed in the Bureau to collect and tabulate the various treaties with the Indian tribes relating to the cession and transfer of lands. The work was substantially completed, and the lands affected by the various treaties described in schedules and platted on maps. These schedules and maps were duly turned in by Mr Royce and were added to the archives of the office for use in connection with the more strictly ethnologic researches. Since that date frequent requests for information concerning the Indian land treaties have been received, and thereby the value and accuracy of the work has been fully tested. During the year the demand for such information so increased that it was decided to submit the material for publication. While the schedules and maps were in most respects ready for printing, revision of certain portions seemed to be required, and a general introduction was thought to be desirable. Accordingly, in November the work of revision was assigned to Dr Cyrus Thomas, who also undertook the preparation of the requisite introductory chapter. The remainder of the fiscal year was spent by Dr Thomas chiefly in the completion of this task, which was not quite done at the end of that time.

LINGUISTICS

As the researches relating to primitive peoples in this and other countries progressed, the importance of linguistic studies became more and more apparent. Mankind is preeminent partly because of a variety of individual characteristics, yet in large measure because of social organization; and it is through organization that men have been successively raised from savagery to barbarism, from barbarism to civilization, and from simple civilization to the highest enlightenment and humanity. Now, the basis of organization is expression, and the art of expression is accordingly paramount among the arts of men, and ethnologists have found that the grade of development and the classific relations of peoples are more justly indicated by their arts of oral expression than in any other way. Thus the accepted ethnologic classification in this and other countries is primarily linguistic.

The importance of linguistic researches has been recognized in the Bureau of American Ethnology from the outset, and much labor has been expended in the collection of linguistic literature as a basis for the classification of the tribes and also as a means for still further extending the principles of ethnic classification.

During the last fiscal year this branch of the work has been carried forward continuously by Dr Albert S. Gatschet and Mr J. N. B. Hewitt, and during a part of the year by the Director and Mr J. Owen Dorsey.

The work of the Director in linguistics during the year was largely ancillary to the researches in psychology and in anthropologic classification. In this connection portions of the rich store of linguistic manuscripts were examined, and the principles of linguistic development were formulated for the use of the collaborators.

Mr J. Owen Dorsey was occupied during July in (1) the preparation of a catalog of the Teton-Dakota manuscripts by Messrs Bushotter and Bruyier, in possession of the Bureau, and (2) the continuation of his work on the Winnebago texts and dictionary slips, noted in previous reports. During August the first of these lines of work was completed, and he then rearranged the linguistic manuscripts in the fireproof vaults of the Bureau. Many of these manuscripts are unique. A large proportion represent the work of the regular collaborators of the Bureau, but several have been derived from other sources by exchange or by donation, through the interest in the subject developed early in the history of the Bureau. The material is of great scientific value, and it is deemed important that it should be arranged in readily accessible form, in connection with a suitable catalog. On completing this task, Mr Dorsey resumed the preparation of material for the synonymy of the Siouan stock, in connection with which he prepared during November a brief memoir on "Siouan Sociology," which was afterward revised by Mr McGee for incorporation in the Fifteenth Annual Report of the Bureau. During December Mr Dorsey's work was interrupted by illness, which, to the great loss of science, terminated fatally.

At the beginning of the fiscal year Dr Gatschet was engaged in elaborating the large body of Shawnee linguistic material described in preceding reports. This work was continued until the end of September, and a large number of lexic and grammatic elements were extracted and arranged on cards. In connection with this work Dr Gatschet prepared an ethnographic sketch of the Shawnee for incorporation in the cyclopedia of Indian tribes and carried forward his comparative tabulation of the phonetics, grammar, etymology, and syntaxis of all the Algonquian dialects. Special attention was given to this comparative work throughout the remaining portion of the year. During June particular attention was given to the Peoria linguistics, which Dr Gatschet has continued to elaborate in connection with his comparative work on the Algonquian languages. The studies and comparisons of this material indicate that it is in condition for publication so far as the vocabulary is concerned, though further material will be required before the grammar can be perfected. There is now in the Bureau archives a large body of carefully selected material relating to the Algonquian languages, collected mainly through Dr Gatschet's persevering industry. Considerable portions of the material are substantially ready for publication; but it seems desirable, before sending the matter to the press, to extend researches concerning certain of the dialects and to introduce the whole by a discussion of the modes of development and the means of dialectal differentiation. A part of the Director's work during the year was contributed toward such an introduction and discussion.

Mr J. N. B. Hewitt was occupied during a part of the year in transcribing in form for publication the Tubari vocabulary collected during the last fiscal year by Dr Carl Lumholtz, and in making comparative studies of this and other material obtained by Dr Lumholtz and other explorers and ethnologists in southwestern United States and Mexico. The task of preparing the Tubari material for publication proved to be great, but was nearly completed during the fiscal year. When ready for printing, the monograph will be a unique and invaluable record of a once numerous tribe, now nearly extinct.

At intervals during the year Mr Hewitt was engaged in a comparative study of the pronoun as used by various Indian tribes. The pronoun is an important element in primitive speech, and has received much attention from linguists and philologists in many parts of the world. The archives of the Bureau now afford a more extended basis for research concerning this element than is known to exist elsewhere, and this material has been used efficiently and successfully by Mr Hewitt in his researches.

Although the discussion of the subject was well advanced at the close of the fiscal year, it was not yet in form for publication.

MYTHOLOGY

Mrs Matilda C. Stevenson continued the revision of notes and the final writing of manuscript for her report on the Zuñi Indians. This elaborate report has been in preparation several months. In view of the great number and interest of the ceremonials and the significant nature of the beliefs of the Zuñi Indians, it is thought desirable to spare no pains in making it as nearly exhaustive as possible, and thus all details of ceremonial and belief are receiving attention, necessarily at considerable expense in time.

Mr Frank Hamilton Cushing has been engaged in interesting researches concerning the significance of the arrow in primitive thought, custom, and symbolism. Recent investigations of games of divination, American and Oriental, by Mr Stuart Culin (with whom Mr Cushing has in some measure cooperated) and by other students in this country and abroad, have shown that among many primitive peoples games are conducted ceremonially rather than for amusement, and that the games are commonly divinatory. The researches have shown also that the arrow, either in itself or by symbol, is an essential element in such divinatory games. One of the results of these researches is a demonstration of the world-wide use of the arrow and of the existence of close analogies, if not homologies, in fundamental symbolism among the primitive peoples of several continents. The researches also indicate relative recency in origin of many of the games

played for amusement among civilized peoples; and they show the origin and successive stages of development of many of these games with remarkable clearness. In scientific research each well-established conclusion gives a new point of view from which the student is able to see farther than before into the unknown, and from which also he is able to see relations among the known more clearly than before. This is strictly true of Mr Cushing's researches concerning the arrow. His preliminary conclusions have afforded insight into various primitive customs and ideas.

PSYCHOLOGY

Throughout the fiscal year the attention of the Director has been given chiefly to the development of a classification of the races of mankind with special reference to the American tribes. To this end the physical and mental attributes of the tribes were considered in detail; and at the same time the art products were studied as the tangible expression of mental attributes. Pursuing the investigation, it became evident that the distinctive characteristics of individuals, tribes, and peoples are substantially intellectual. In this way the Director was led to an analysis of the psychic characteristics of mankind. At first the subject was obscure and apparently so complex as to discourage investigation; but as the work progressed, and as arts, organization, beliefs, and ceremonials were interpreted as expressions of psychic organization, the causes of apparently unrelated facts fell into order, and substantial progress was made in the researches. During recent months it has been found that the researches concerning mental attributes of the American Indians afford a clue to the differentiation of individuals and families, and the coalescence of groups, and the development of individual and collective attributes. Thus the researches in psychology have already yielded a basis for the classification of the native tribes, and have illumined the aboriginal arts, institutions, and beliefs.

Considerable progress has been made in the preparation of an extended report on the classification of the native races and their attributes on a comprehensive psychic basis; but the memoir remained unfinished at the end of the year.

BIBLIOGRAPHY

Notwithstanding the serious condition of his health, Mr James C. Pilling continued almost uninterruptedly the compilation of the bibliography of the languages of the North American Indians. The early part of the year was devoted specially to the preparation of the Shahaptian bibliography; but realizing the gradual failure of his strength, Mr Pilling decided to lay aside this work and to devote his energy to the more important and extensive bibliography of the Mexican languages, and in this labor he was engaged until toward the close of the year, when, his strength having become completely exhausted, he was compelled to abandon it. This bibliography, however, is left in such condition that it is believed the compilation may be made ready for publication without great labor. With the possible exception of the Algonquian bibliography, the bibliography of the Mexican languages will be the most voluminous of the entire series, and many inquiries concerning and applications for the volume have already been made by students. After a long and faithful career in behalf of the Bureau of American Ethnology, the fruits of which are known the world over, Mr Pilling's services terminated with the close of the month of May.

PUBLICATION

Satisfactory progress was made with the publications of the Bureau during the year, the editorial work being conducted under the immediate direction of the Ethnologist in Charge, aided largely by Mr F. W. Hodge and Mr George M. Wood. As stated in the report for the fiscal year ending June 30, 1894, the first proofs of the Thirteenth Annual Report were received from the Public Printer in June; by the beginning of October the entire volume, with the exception of the administrative report and the index, was in page form; the former has since been prepared and transmitted, and the compilation of the index was well under way at the close of the year.

On June 1 the manuscript of the text and illustrations for the Fourteenth Annual Report, and on June 14 the copy for the Fifteenth Annual Report, were transmitted to the printer, but no proofs had been received at the close of the year.

Proof reading of the bulletin bearing the title "Chinook Texts," by Franz Boas, was continued from the last fiscal year (when 176 pages were in type) and carried to completion by the middle of December. The edition of this bulletin was delivered in May, 1895.

Final proof reading of the bulletin "An Ancient Quarry in Indian Territory," by W. H. Holmes, was also completed, and in October the brochure was ready for distribution.

Early in August the manuscripts of three other bulletins were transmitted to the Public Printer. One of these, the "List of Publications of the Bureau of Ethnology," by F. W. Hodge, was received shortly afterward, and in November the edition was delivered. In September the first proofs of "Archeologic Investigations in James and Potomac Valleys," by Gerard Fowke, were received. By the close of the year the proof reading was completed, and the edition was delivered by the Government Printing Office in May, 1895. During the same period proof of the bulletin entitled "Siouan Tribes of the East," by James Mooney, was read, and the edition received also in May.

To summarize, the following publications were delivered by the Public Printer and transmitted to the regular correspondents of the Bureau during the fiscal year:

Eleventh Annual Report, for 1889–90, containing, in addition to the Director's report of 25 pages, the following memoirs: (1) "The Sia," by Matilda C. Stevenson; pages 3 to 157, plates I–XXXV, figures 1–20. (2) "Ethnology of the Ungava District," by Lucien M. Turner; pages 159 to 349, plates XXXVI–XLIII, figures 21–155. (3) "A Study of Siouan Cults," by J. Owen Dorsey; pages 351 to 544, plates XLIV–L, figures 156–200.

Twelfth Annual Report, for 1890–91, containing, in addition to the Director's account (28 pages) of the administration of the Bureau during the year, the following: "Report on the Mound Explorations of the Bureau of Ethnology," by Cyrus Thomas; pages 3 to 722, plates I–XLII, figures 1–344.

Contributions to North American Ethnology, volume IX, comprising "Dakota Grammar, Texts, and Ethnography," by S. R. Riggs, edited by J. Owen Dorsey; XXXII, 239 pages.

Bulletin T=20, "Chinook Texts," by Franz Boas; 278 pages, 1 plate.

Bulletin U=21, "An Ancient Quarry in Indian Territory," by W. H. Holmes; 19 pages, 12 plates, 7 figures.

Bulletin V=22, "Siouan Tribes of the East," by James Mooney; 100 pages, map.

Bulletin W=23, "Archeologic Investigations in James and Potomac Valleys," by Gerard Fowke; 80 pages, 17 figures.

Bulletin X=24, "List of the Publications of the Bureau of Ethnology," by F. W. Hodge; 25 pages.

MISCELLANEOUS

Library—The growth of the library, mainly through exchange with scientific institutions and individuals throughout the world, has been steady. The number of volumes in possession of the Bureau is 5,029, an increase of 679 volumes since the last fiscal year. The accession of pamphlets and periodicals during the same period has been proportionately large.

Illustrations—The preparation of illustrations for the publications of the Bureau has been continued under the direct supervision of Mr DeLancey W. Gill, to whose artistic skill and intelligent interest in anthropologic subjects the high standard of the pictorial part of the Bureau's published works is largely due.

Photographs—In addition to the excellent series of photographs made by Mr William Dinwiddie, under the direction of Mr McGee, during the season of exploration among the Seri and Papago, and those made by Mr Mindeleff in Canyon de Chelly, individual and group photographs were made of an Osage and an Oto delegation who visited Washington in February and March, respectively.

Exposition—During the closing months of the fiscal year a collection was prepared for exhibition at the International and Cotton States Exposition, held in Atlanta during the

summer of 1895. The exhibit prepared by the Bureau was a part of that of the Smithsonian Institution; it was designed to occupy an alcove in the Government building. Six wall cases and four floor cases were provided; and there were, in addition, a number of large objects prepared for placing on the tops of the cases, together with a series of twelve transparencies. The material was selected to illustrate three tribes, viz: (1) The Cherokee Indians, whose ancestors formerly occupied northern Georgia; (2) the Papago Indians, a peaceful tribe of Arizona and Sonora (Mexico); and (3) the Seri Indians, a warlike tribe of Tiburon island in the Gulf of California and the adjacent mainland of Sonora. The collections representing the Cherokee Indians were made some years ago by Mr Mooney, and were withdrawn from the National Museum for the purposes of the exposition; the collections representing the Papago and Seri Indians were the product of recent exploration by Mr McGee, described elsewhere in this report.

NECROLOGY

GARRICK MALLERY

Colonel Garrick Mallery, who died at his home in Washington, October 24, 1894, was born in Wilkesbarre, Pennsylvania, April 23, 1831. After his graduation at Yale College and a due course of study under the direction of his father, Judge Garrick Mallery, he began the practice of law in Philadelphia, which he continued until the outbreak of the civil war, when he entered the volunteer service as captain in the Seventy-first Pennsylvania Infantry. Throughout the rebellion Mallery displayed unusual bravery. In June, 1862, at the battle of Peach Orchard, Virginia, he was twice severely wounded, and while lying on the battlefield was captured and sent to Libby Prison, at Richmond, where he remained until exchanged and sent to his home at Philadelphia. As soon as he had sufficiently recovered from his wounds, Mallery returned to duty and became lieutenant-colonel of the Thirteenth Pennsylvania cavalry, which position he retained until the close of the war.

In 1866 he was commissioned captain of the Forty-third infantry of the regular army, and later the brevet rank of colonel was bestowed on him for gallant and meritorious services. His scientific knowledge was early recognized by the War Department, and in 1870 he was detailed to execute a plan adopted by Congress for the prosecution of meteorological researches by the Signal Service, and in this connection frequently acted as chief signal officer of the army.

Colonel Mallery's studies of the ethnology of the Indians of North America began with his military service on the frontier. In 1876 he was assigned to the command of Fort Rice, Dakota, where he became absorbed in the sign language and pictography of the plains tribes. His writings on these subjects soon became well and favorably known, and on the organization of the Bureau of Ethnology in 1879 his services were at once engaged by the Director for the prosecution of the researches he had so well begun. In 1880 his "Introduction to the Study of Sign Language Among the North American Indians as Illustrating the Gesture Speech of Mankind," was published, followed immediately by "A Collection of Gesture Signs and Signals of the North American Indians, with Some Comparisons." The latter volume formed the basis of his memoir on "Pictographs of the North American Indians," a preliminary paper of 256 pages published in the Fourth Annual Report of the Bureau, and the greatly extended memoir of 807 pages and over 1,300 illustrations bearing the title "Picture Writing of the American Indians"—a monument to his industry and ingenious research—comprising the body of the Tenth Annual Report of the Bureau. Colonel Mallery's "Sign Language Among North American Indians Compared with that Among other People and Deaf-Mutes," which appeared in the First Annual Report of the Bureau, was based on his "Collection of Gesture Signs and Signals," but even this monograph of 290 pages and 300 illustrations was regarded only as preliminary, his great work on this subject remaining unfinished at the time of his death.

Colonel Mallery was the first to direct serious attention to the investigation of the population of the American aborigines

in past times as compared to the present, and his paper, "The Former and Present Number of Our Indians," effectually exploded the old theory that the aboriginal population of America at the time of the discovery was much greater than at the present period. But Colonel Mallery's anthropologic researches were not confined to the American Indians. His studies in general sociology show a wide and intimate acquaintance with the literature and peoples of both continents, and his various writings exemplify his scholarly taste and strong power of philosophic comparison. Among the papers pertaining to this subject prepared by Colonel Mallery are: "Manners and Meals," "Greeting by Gesture," "Customs of Courtesy," "Philosophy and Specialties," and "The Gesture Speech of Man." His study, "Israelite and Indian—a Parallel in Planes of Culture," provoked much discussion among scientific men, and was translated into the German by Dr Frederick S. Krauss.

In the words of a lifelong friend, Garrick Mallery was "the gallant soldier with a stainless record; the scholar largely read in the literature of his own and other times; the man of science who has left an imperishable record of ingenious and far-reaching research; the trusted councilor in the societies which honored him with their highest dignities; the genial companion; the affectionate husband; the staunch friend; the high-bred gentleman."

JAMES OWEN DORSEY

In the death of Mr Dorsey American ethnology lost a brilliant student. Born in Baltimore October 31, 1848, he acquired his primary education in the schools of his native city. At an early age he evinced a marked precocity in the acquirement of language; it is said that at 6 he learned the Hebrew alphabet, and ere he reached his eleventh year he could read the language with facility. At 14 young Dorsey entered the Central High School, now City College, and pursued the classic course, but during his second year he was constrained to abandon his studies by reason of ill health. In the autumn of 1867 he entered the preparatory department of the Theological

Seminary of Virginia, and the junior class in 1869. Two years later he was ordained a deacon of the Protestant Episcopal Church, and in May began mission work among the Ponka Indians of Dakota Territory. But the rigorous climate and the vicissitudes of early frontier life soon affected his health, which was never robust, and after serious attacks of illness in July, 1872, and early in 1873, he was compelled to abandon his mission work in August of the latter year, soon after he had acquired the ability to converse with the Indians without the aid of an interpreter. Returning to Maryland, he was engaged in parish work until July, 1878.

While pursuing his work as missionary among the Indians, Mr Dorsey became a correspondent of the Smithsonian Institution. His profound knowledge of the dialects of the Siouan languages early attracted the attention of Major J. W. Powell, at whose instance he was sent among the Omaha tribe in 1878 for the purpose of acquiring additional linguistic and other anthropologic material, remaining among that people until the spring of 1880. In the meantime, on the organization of the Bureau of Ethnology, in 1879, he was immediately chosen one of the scientific corps and was arduously engaged in linguistic and sociologic work up to the time of the illness which terminated in his death at Washington on February 4, 1895.

His great modesty and his strong conviction that the views of a student should be molded by truths prevented him from formulating subjective theories by which to judge the value of his facts. In the later years of his studies in linguistic morphology he began to feel the inadequacy of the venerable agglutination theory to explain all the facts of word structure prevailing in the languages he was studying, and he came to look upon adaptation—the infusing with a new meaning or function an element which before had or had not any definite signification—as an important and potent factor in the genesis and development of morphologic structures. His mastery of the wealth of forms in the languages he studied enabled him to illustrate copiously the working of this principle. His linguistic acumen and painstaking accuracy are brought out in his interlinear translations of numerous and voluminous texts,

both in print and in manuscript. His marvelous aptitude in discriminating, grasping, and retaining sounds enabled him to obtain accurate vocabularies and texts with great ease, and to detect differences of meaning and function through differences of sound. His freedom from subjective theories, his deep erudition, and enlightened conservatism made him one of the foremost authorities in American linguistics.

In addition to numerous essays dealing with the linguistic and other anthropologic matters which appeared from time to time in various periodicals, Mr Dorsey published, under the auspices of the Bureau of Ethnology, the following excellent and suggestive memoirs: "Omaha Sociology," "Osage Traditions," "A Study of Siouan Cults," "Omaha Dwellings, Furniture, and Implements;" "Omaha and Ponka Letters," and "The ɸegiha Language, with Myths, Stories, and Letters." He also edited the "Dakota-English Dictionary," and "Dakota Grammar, Texts, and Ethnography" of the late Reverend S. R. Riggs, forming, respectively, volumes VII and IX of Contributions to North American Ethnology. At the time of his death he had practically completed the paper on "Siouan Sociology," published in the Fifteenth Annual Report. Among the papers and articles of marked importance published in extra-governmental media may be mentioned "Migrations of Siouan Tribes," "Comparative Phonology of Four Siouan Languages," "An Account of the War Customs of the Osages," "Mourning and War Customs of the Kansas," "Teton Folklore," "Camping Circles of Siouan Tribes," "Places of Gentes in Siouan Camping Circles," "Games of Teton Dakota Children," and "Siouan Onomatopes."

By reason of the purity and unselfishness of his motives, and the warmth and sunshine of his amiable nature, he won the esteem of all who had the pleasure of meeting him, and, being ever kind, affable, and cheerful to his colleagues, ever willing to aid and advise them, James Owen Dorsey was sincerely and cordially loved and revered by all.

FINANCIAL STATEMENT

Appropriation by Congress for the fiscal year ending June 30, 1895, for continuing ethnological researches among the American Indians, under the direction of the Smithsonian Institution, including salaries or compensation of all necessary employees (sundry civil act, approved August 18, 1894)		$40,000.00	
Balance from fiscal year ending June 30, 1894, not reverting under Comptroller's ruling		1,698.00	
			$41,698.00
Salaries or compensation for services		31,201.19	
Traveling and field expenses	$3,908.82		
Illustrations	1,159.15		
Office rental	999.96		
Ethnic material (specimens, etc)	794.43		
Photographic laboratory	727.49		
Office furniture	723.46		
Publications for library	678.53		
Stationery	653.04		
Freight	372.28		
Temporary services	174.00		
Miscellaneous and incidentals	262.28		
		10,453.44	
			41,654.63
Balance July 1, 1895			43.37

CHARACTERIZATION OF ACCOMPANYING PAPERS

SUBJECTS TREATED

The Bureau of American Ethnology is an outgrowth of the United States Geographical and Geological Survey of the Rocky Mountain Region. Previous to 1879 there were four governmental surveys at work in the western territories. Primarily they were geographic and geologic, but three of them gave attention to the native races in their respective districts, and in the Rocky Mountain Survey research concerning the Indians was regarded as an important line of work. In 1879 the organizations were consolidated. The geographic and geologic work was entrusted to the present United States Geological Survey, while the ethnologic work was transferred to a new bureau instituted under the Smithsonian Institution, and this office has since been maintained as the Bureau of American Ethnology. The earlier researches indicated that all the American aborigines are measurably similar in arts, industries, laws, languages, and opinions, or in their various demotic features, so that the tribes of any district can not be successfully studied without observation among the tribes of other districts—i. e., the early observations showed that, while the aborigines were organized in distinct tribes and other groups, they were not widely distinct in cultural development. During the operations of the antecedent survey this fundamental fact was recognized, and when a series of reports on the aborigines was commenced, they were entitled "Contributions to North American Ethnology," and the subjects treated in the series represented various portions of the North American continent from the Isthmus of Panama on the south to the shores of the Arctic on the north. Partly by reason of the information published in these reports, the similarity of the American natives in culture grade came

to be recognized by statesmen; and when the new bureau was instituted, it was specifically provided in the organic law that the researches continued within it should extend to the North American Indians.

Special conditions, which have been set forth in previous reports, led to the concentration of early work in the United States and among those tribes which were about to be gathered on reservations; but while the plan for general work was thus temporarily modified, it was never abandoned. As the researches progressed, it was found that the aborigines of South America, like those of the North American continent, are partly in the higher stages of savagery and the lower stages of barbarism—it was found, indeed, that the aborigines of the two Americas constitute a single people, and that the demotic characteristics of either part can not be fully ascertained without reference to those of the other part. Accordingly, attention was given to the aboriginal activities of South America, and, although field operations were not extended into that continent, several memoirs pertaining to South America were published in the reports. As the work progressed, the similarity of the American natives was still more clearly recognized by statesmen, and in 1885 the law providing for the maintenance of the Bureau was made to provide for "continuing ethnological researches among the American Indians." About the same time some increase was made in the appropriation to facilitate extension of the work, and thereupon the researches relating to the antiquities of Mexico, already begun in a small way, were pushed forward with renewed vigor. Recently field work has been extended into Mexico, and arrangements have been made for obtaining collections and photographs from different parts of South America. Some of the results of this extension of the field of operations by the Bureau are incorporated in the present report.

In geographic distribution, the subjects of the accompanying memoirs range from the pueblo region of the United States through Mexico to Peru. The first paper deals with primitive surgery in the land of the Incas, apparently antedating that higher aboriginal culture which astonished all Europe

when the reports of the explorers crossed the Atlantic. The field operations out of which this paper grew were made independently of the Bureau by an officer of the Peruvian government; but the greater part of the study was carried forward in the Bureau, while the material studied becomes the property of the United States and is preserved in the National Museum. The second paper embodies the results of extended surveys in the northern part of the pueblo country. In this case the work in field and office was carried forward wholly in the Bureau, and the collections are preserved in the National Museum. The third paper finds its subject in Yucatan, a region of remarkable aboriginal culture, approaching that of Peru in advancement; the material studied comprises reproductions of autographic records preserved in several institutions, mostly European. The fourth paper deals with a restricted area in the pueblo country; the field operations were performed at the cost of the Bureau, with the primary purpose of obtaining collections which are now public property and duly installed in the Museum.

Classed with respect to the Caucasian invasion, and thus to the beginning of history and acculturation, three papers deal with the prehistoric; the fourth deals with an essentially aboriginal ceremonial custom which has survived nearly three and a half centuries of contact with white men. Thus the time range covered by the papers is considerable.

The memoir by Messrs Muñiz and McGee deals with a primitive surgery and the instruments and facilities employed therein, and thus belongs to technology; at the same time, the discussion extends into the field of primitive ideas concerning the cause and cure of disease, and thus pertains also to sophiology. Mr Mindeleff's memoir pertains primarily to the technology of the prehistoric peoples of the pueblos; yet incidentally it touches on the sociology and sophiology of the people as expressed in their handiwork. The brief paper by Dr Thomas embodies the results of researches concerning devices for graphic expression, and thus relates to one of the branches of philology. The preliminary memoir by Dr Fewkes deals primarily with the highly differentiated beliefs of a people

living in a peculiar environment, and secondarily with the arts growing out of the beliefs. Thus the descriptions and discussions of the accompanying papers cover a great part of the range in human activities.

PRIMITIVE TREPHINING IN PERU

In every stage of development, knowledge is a resultant of preconception and observation; and it is a striking and at first sight paradoxical fact that knowledge advances chiefly through the weakening and gradual elimination of the preconceptional component. It is under this general law that knowledge progresses from the remote to the near, from the abnormal to the normal, from the ideal to the real; and it follows that, when any two stages in the progress of knowledge are compared, the earlier is the more heavily burdened with preconception, speculation, vague hypothesis, and mysticism. In accordance with this law, the barbarian has fewer deductive hypotheses and more inductive inferences, relatively to the sum of his opinions, than the savage; the civilized man has relatively fewer hypotheses than the barbarian; and, in proportion to the aggregate of knowledge, scientific men are dominated by speculative ideas in a less degree than any other class of mankind. This law of the growth of knowledge is well exemplified in the development of medicine and surgery. Among savages, medical practice is little more than divination, sortilege, or exorcism, performed by the shaman or priest, which may chance to benefit the patient or may aggravate the disorder; but gradually the element of experience enters, and those modes of treatment which result beneficially tend to persist, while those that work injury tend to disappear. As experiences accumulate the treatment improves, though the irrelevant vagaries of the shamans are long retained; thus modes of treatment become established, while the extravagancies of primitive ideation are gradually forgotten. In this way empiric medicine arises; and empiricism in turn gradually gives place to scientific medicine, through the elimination of meaningless motives coupled with the development of a

rational etiology. In many respects the history of practical medicine and surgery exemplifies the history of sophiology.

As pointed out in the accompanying paper, trephining, although one of the boldest operations of modern surgery, is in certain regions more characteristic of primitive culture than of civilization. In different countries students have been surprised at its prevalence and the apparent recklessness with which the operation is performed by skilless shamans for apparently trivial reasons. Perhaps the best figures for determining the ratio of frequency of trephining are those afforded by the Muñiz collection of over a thousand crania, of which 2 percent are trephined, several more than once, so that the ratio of operations to individuals is almost exactly 2.5 percent; a ratio probably higher than that of modern hospital practice in any country, and many times higher than that of general practice. It may be observed that there is nothing to indicate vitiation of this ratio by the selection of trephined crania and the rejection of entire skulls on the part of the collector, since Dr Muñiz' collection was made for general scientific purposes, so that all of the observed mummies were retained, and since, in most cases, the operation was not detected until the crania were subjected to critical examination in the laboratory. The frequency with which the operation was performed would indicate that, if it were surgical in the modern acceptation of the term, a high degree of surgical skill must have existed among the ancient Peruvians; and the fact that there is no indication of skill in the crude cutting awakens a suspicion that the operators were not surgeons in any proper sense, and this despite the ready inference from about a third of the specimens in which the operations were evidently located by antecedent injuries. On critical examination of all of the specimens, the suspicion is confirmed and grows into a conviction that the ancient operators were nothing more than primitive practitioners occupying the same culture grade as the shamans or "medicine men" of the North American tribes.

The discussion of trephining in general is noteworthy in that it indicates with strong probability the course of development followed by this branch of surgery. It has long been known that savage warriors take scalps and other trophies

from slain enemies; it is recognized by careful students that the primary motive in taking such trophies is thaumaturgic or necromantic, growing out of the belief that the strength, valor, or other qualities of the slain enemy will be magically transferred to the slayer by this means. It has long been known, also, that in prehistoric times cadavers were trephined for the purpose of obtaining amulets. Now these and other facts have been brought together in a sequential order suggested by the development of beliefs, and it becomes evident that the operation of trephining was originally postmortem and thaumaturgic or magical. It seems highly probable that in the next stage the operation became antemortem, and partook of the nature of the ordeal, a form of divination characteristic of many peoples, which has extended into the present century even in civilized nations. From this stage it is easy to trace the history of the operation, the remaining stages being represented among well-known peoples, primitive and advanced. The history of this branch of surgery, beginning with the mutilation of the dead and ending with the reconstruction of the living, is highly significant; it would be difficult to find a more striking case of the survival of modes of conduct despite transformation of motive.

It is noteworthy that the prehistoric trephining of Peru blends with the shamanistic procedure of the North American tribes in such manner that each illumines the other. The significance of the Peruvian trephining could not have been ascertained without the knowledge of primitive ideation gained through study of the Indians of our own woodlands, prairies, and mountains, while certain symbolic features in the ceremonials of the pueblo peoples can be interpreted only in the light of the information afforded by study of the Peruvian trephining. Thus the paper incidentally establishes the substantial unity of the aboriginal people and aboriginal culture of the Western Hemisphere.

THE CLIFF RUINS OF CANYON DE CHELLY, ARIZONA

Perhaps the most important lesson learned through researches concerning the American tribes is that primitive peoples reflect their environment. Even the most casual observation shows

that coastwise tribes are fishermen and hunters, that the tribes of the woodlands are primarily hunters and warriors, that the tribes of the prairies are hunters or farmers according to conditions, and that the tribes of the irrigable deserts are peaceful farmers, usually with predatory neighbors who are primarily hunters of mountain game; so that he who runs may read the patent fact that the industries of primitive men are shaped directly by environing conditions. Little additional study is required to show that the sports, games, decorations, portraiture, and other esthetic arts also reflect environment, since the sport mimics the industry, the gaming apparatus is of local origin and the gaming ideas run parallel to the industrial ideas engendered by daily association, the decoration is local in material and design, and the portraiture, howsoever crude, represents familiar things. So, too, comparatively little study is required to show that the institutions or laws and government of a primitive people reflect surroundings. On food-yielding coasts the families and tribes are organized for fishing, in the forests they are organized for the chase or for war, on the prairies they are organized for agriculture or for the hunting of herbivores, in the valleys of the arid region they are organized for agriculture and for defense, and in the neighboring mountains they are organized for predation and the chase. Thus the social organization is bound up with the industries and thereby with the local conditions so intimately that every step in institutional progress (e. g., the transition from clan organization to gentile organization) depends primarily on the habitat, with its distinctive conditions of soil, temperature, rainfall, etc. More careful study is required to show that the language of each tribe reflects local conditions, for while it is plain that local objects and those alone require names, it is not so readily evident that the more complex ideas expressed in other parts of speech represent merely the compounding of local terms by intellectual methods growing out of modes of action themselves determined by environment; yet careful analysis shows this to be the case. The connection between environment and belief seems still more remote, yet recent researches show that the concept of the sun god arises under

certain conditions, that the idea of the storm god is largely a local product, that the faith in the rain god is the product of arid environment, that the venerated beast gods are but the sublimed animals of the adjacent range, and that all other primitive deities, and the primitive ceremonials through which they are exalted, reflect local conditions with remarkable fidelity. It is to be borne in mind that the natural districts overlap, and also that, even among the American aborigines, there was a long history of the blending of tribes, and so of arts, industries, laws, languages, and philosophies before the white man came, so that certain products of human activity were already common property; but a sufficient number of provincial products remain to indicate clearly the early course of human development, beginning with the stage in which man reflects his environment with close fidelity.

Mr Mindeleff's paper on the cliff dwellings of Canyon de Chelly is a faithful account of the ruins of a little-known district. This district is noteworthy for the permanence and development of the type of habitation known as the cliff dwelling; here more than elsewhere in the United States, or indeed in North America, the domiciles of the cliffs are characteristic. The reason for the prevalence of this house type (which is, perhaps, too primitive to be regarded as an architectural type) is not far to seek. The district is one of arid plateaus, separated and dissected by deep canyons; the plateaus, and thus the canyon walls, are frequently composed of flat-lying rock strata of such composition as to form ledge-marked cliffs under the influence of the erosion wrought by the rare storms; only along the few streams heading in the mountains and encircling the plateaus does permanent water exist, and along the cliff lines slabs of rock suitable for building abound. These and other local conditions favored the construction of cliff dwellings and opposed the erection of other types of domicile; and the primitive ancients, dependent as they were on environment, naturally produced the cliff dwellings. The tendency toward this type of domicile was strengthened by intertribal relations; the cliff dwellers were probably descended from agricultural or semiagricultural villagers who

sought protection against enemies and the control of lands and waters through aggregation in communities. It is practically certain that they migrated, probably under the stress of predation by neighboring tribes, into this district, in which they were fain to gather for sustenance and mutual protection on easily defended sites near the moist or irrigable bottom lands on which their maize and beans and other crops were planted and harvested. Thus the cliff dwellers and their works illustrate forcibly the dependence of primitive men on their immediate surroundings.

The chief ruins described by Mr Mindeleff are those of both permanent and temporary habitations; but these were so constructed and disposed as to indicate a considerable range of industries. At the same time the structures and the associated relics throw light on the primitive arts, and also on the social organization, and even on the fiducial system of the ancient cliff dwellers. Numerous interrelations are brought out in the memoir; others remain for fuller presentation as the researches in the pueblo country mature.

It may be noted that Mr Mindeleff's work tends to correct a misapprehension which grew up in the early days of American ethnology, and which still retains some hold, i. e., that the cliff dwellers were one of a number of essentially distinct peoples. His observations show that the cliff dwellings were merely a type of habitation rendered necessary by surroundings, and that the people who built them also established temporary habitations on indefensible sites located more conveniently with respect to tillable lands; and they show, also, that the cliff type of domicile grades into the pueblo type, whether of rock or of adobe, as local conditions required. These observations, with others, demonstrate, indeed, that the cliff people were nothing more than Indians, sometimes not related among one another by consanguinity or institutional affinities, yet related in most of their characteristics, not only among each other but with the neighboring tribes, and, through these, with all of the aborigines of the continent. Locally, the ancient villages of Canyon de Chelly, whether in the cliffs, on the mesas, or over the bottom lands, are known as

Aztec ruins, and the suggestion of this designation is just in so far as it implies relationship with the aborigines of moderately advanced culture in Mexico and Central America, though it would be misleading if regarded as indicating essential difference between the ancient villagers and their modern descendants and neighbors still occupying the pueblos. The kiva of the cliff village corresponds with the kiva of the pueblo, and is the homologue of the Mexican, Central American, and Peruvian temple on the one hand (as with the prytaneum of classical history), and of the medicine lodge of the plains on the other hand; and in other respects the products of activity among the cliffs of Canyon de Chelly are identical with those found elsewhere on both American continents. Thus this memoir also serves, in one of its several aspects, to indicate the demotic unity of the aborigines of the Western Hemisphere.

DAY SYMBOLS OF THE MAYA YEAR

Most of the American tribes had advanced to the stage of graphic symbolism, and were thus on the threshold of writing, when the new world was discovered by Columbus. Among many of the tribes the art was rudimentary, and limited to crude pictography. The pictographs were painted or sculptured on cliff faces, bowlders, the walls of caverns, and other rock surfaces, and even more frequently, though less permanently, on trees, as well as on skins, bark, and various artificial objects. These crude autographic records of the Indians of the United States have been studied with care, and many of them have been illustrated and interpreted in earlier reports. Among certain Mexican tribes, also, autographic records were in use, and some of them were much better differentiated than any within the present area of the United States. The records were not only painted and sculptured on stone and molded in stucco, but were inscribed in books or codices of native parchment and paper; while the characters were measurably arbitrary, i. e., ideographic rather than pictographic. The various records fall into a series representing several early stages in the development of writing, and throw a clear light on the origin of one of the most beneficial among human arts.

Partly through study of the autographic records, though chiefly through personal conference, the calendars of different American tribes are known. Among the plains Indians the calendars are simple, consisting commonly of a record of winters (from which they are sometimes known as "winter counts") and of notable events occurring either during the winter or during some other season of the year; while the shorter time divisions are reckoned by "nights" (days), "dead moons" (lunations), and seasons of leafing, flowering, or fruiting of plants, migrating of animals, etc; and there is no definite system of reducing days to lunations or lunations to years. Among the pueblo Indians calendric records are inconspicuous or absent, though there is a much more definite calendric system which is fixed and perpetuated by religious ceremonies; while among some of the Mexican tribes there are elaborate calendric systems combined with complete calendric records. The perfection of the calendar among the Maya and Nahua Indians is indicated by the fact that not only were 365 days reckoned as a year, but the bissextile was recognized—indeed some astronomers have regarded the calendar of ancient Mexico as even more accurate than the Julian calendar of early Christendom.

During several years Dr Thomas has devoted close attention to the interpretation of the calendric inscriptions found in the Maya codices, and a portion of the results of his researches has been incorporated in earlier reports. His latest publication on the subject appeared in the form of a bulletin entitled "The Maya Year," issued in 1894. In this he demonstrated that the year recorded in the Dresden codex consisted of eighteen months of twenty days each, with five supplemental days, or of three hundred and sixty-five days. In the accompanying paper he discusses at length the origin and significance of the names given to the twenty days of the Mexican month in the Maya language, as well as in the Tzental, Quiche-Cakchiquel, Zapotec, and Nahuatl. In the several languages the names are associative or symbolic in the vague fashion characteristic of prescriptorial ideation; they connote wind, water, rain, various animals and plants, etc, and in most or all

cases the connotation apparently represents derivation. Dr Thomas finds strong indications that the day characters of the codices were phonetic, and one of the purposes of his paper is to set forth the evidence on this point. The discussion is noteworthy in that it brings out the complex, not to say chaotic, mode of thought characterizing that stage of culture in which the art of graphic expression began to assume definite shape. It is noteworthy also as an aid to the interpretation of the simpler calendars of the more northerly tribes.

TUSAYAN SNAKE CEREMONIES

The last report contains a preliminary paper by Dr J. Walter Fewkes on Tusayan katcinas. In characterizing this paper it was pointed out that the pueblo Indians adore a plurality of deities, to which various potencies are ascribed. Most of these deities are held to be zoomorphic, though possessed of mystical powers far transcending those of existing animals. These zoic deities, or beast gods, are worshiped by means of ceremonies which are sometimes highly elaborate; and, so far as practicable, the mystical zoic potency (invisible save in imagery of dream or phantasm of fasting) is represented in the ceremony either by a living animal of similar species or by an artificial symbol. Prominent among the animate representatives of the zoic pantheon throughout the arid region is the serpent, especially the venomous, and hence mysteriously potent, rattlesnake. To the primitive mind there is intimate association between the swift-striking and deadly viper and the lightning, with its attendant rain and thunder; there is intimate association, too, between the moisture-loving reptile of the subdeserts and the lifegiving storms and freshets; and so the native rattlesnake plays an important role in the ceremonies, especially in the invocations for rain, which characterize the entire arid region.

Since the days of the early Spanish explorers Tusayan has been known as the country or range of a group of Indians whose domiciles are gathered in seven pueblos. Under stress of occasional predation, as already set forth, these pueblos were

located on three mesas, or table mountains, known, respectively, as First mesa, Middle mesa, and Third mesa or Oraibi. On the first of these mesas the three villages of Walpi, Sichumovi, and Hano are located; the second carries the three pueblos of Mashongnavi, Shipaulovi, and Shumopavi, while Oraibi alone occupies the third mesa. The people of all of these pueblos except Hano, on the first mesa, belong to the Shoshonean stock and call themselves Hopi, or people; they are also known as Moki, an opprobrious and filthy term applied by alien tribes. The people of Hano belong to the Tewan group of the Tanoan stock, and are affiliated with the Hopi institutionally, although of alien ancestry and still possessed of an alien tongue. This group of pueblos is typical; situated among the plateaus near the center of the northeastern quarter of Arizona, the country is arid; and the beliefs and ceremonies reflect this and other environmental conditions with customary fidelity. So the Ancient of Rattlesnakes is prominent among the zoic deities of Tusayan; and his feeble priest, the living rattlesnake, is impressed into the service of human believers in their ceremonial incantations.

Dr Fewkes has already published an account of the snake ceremonies at Walpi, on the first mesa;[1] the accompanying paper, which is also a preliminary description rather than a final monograph, relates to the similar ceremonies as performed on the middle mesa and at Oraibi. His paragraphs and illustrations present a faithful picture of these interesting ceremonies. The bearings of Dr Fewkes' researches are many and far-reaching: The cult of the serpent is extraordinary, not to say monstrous, and can only be regarded as representing an aberrant branch on the genealogic tree of belief; at the same time it is intimately connected with the immediate surroundings of the believers, so that it must be regarded as largely, if not wholly, the product of a peculiar environment. At the same time the revolting ceremonials of Tusayan fall into position in a series of observances and ceremonials connected with the serpent extending from the plains of the Mississippi to the ancient

[1] The Snake Ceremonials at Walpi, Journal of American Ethnology and Archæology, vol. iv, Boston, 1894.

cities of Mexico, Central America, and even unto far Peru; and some of the most puzzling sculptures, paintings, and inscriptions of the ancient cities, as well as the curious regard for snakes among our northeastern Indians, can be interpreted fully only in the light of the Tusayan researches. Finally, the work bears directly on the much-discussed serpent worship of other continents, and promises to illumine this obscure phase of primitive belief in other lands.

LIST OF PUBLICATIONS OF THE BUREAU OF AMERICAN ETHNOLOGY

(Compiled by Frederick Webb Hodge)

ANNUAL REPORTS

First annual report of the Bureau of Ethnology to the secretary of the Smithsonian institution 1879–'80 by J. W. Powell Director [vignette] Washington Government printing office 1881
Roy. 8°. xxxv, 603 p., 346 fig., 1 map. *Out of print.*

Report of the Director. pp. xi–xxxiii.
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A further contribution to the study of the mortuary customs of the North American Indians, by H. C. Yarrow, act. asst. surg., U. S. A. pp. 87–203, figs. 1–47.
Studies in Central American picture-writing, by Edward S. Holden, professor of mathematics, U. S. Naval Observatory. pp. 205–245, figs. 48–60.
Cessions of land by Indian tribes to the United States: illustrated by those in the state of Indiana, by C. C. Royce. pp. 247–262 and map.
Sign language among North American Indians compared with that among other peoples and deaf-mutes, by Garrick Mallery. pp. 263–552, figs. 61–346.
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Second annual report of the Bureau of Ethnology to the secretary of the Smithsonian institution 1880–'81 by J. W. Powell director [vignette] Washington Government printing office 1883 [1884.]
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Third annual report of the Bureau of Ethnology to the secretary of the Smithsonian institution 1881–'82 by J. W. Powell director [vignette] Washington Government printing office 1884 [1885.]
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Notes on certain Maya and Mexican manuscripts, by Prof. Cyrus Thomas. pp. 3–65, pls. I–IV, figs. 1–11 (10).

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Omaha sociology, by Rev. J. Owen Dorsey. pp. 205–370, pls. XXX–XXXIII, figs. 12–42.

Navajo weavers, by Dr Washington Matthews, U. S. A. pp. 371–391, pls. XXIV–XXXVIII, figs. 42 [*sic*] –59.

Prehistoric textile fabrics of the United States, derived from impressions on pottery, by William H. Holmes. pp. 393–425, pl. XXXIX, figs. 60–115.

Illustrated catalogue of a portion of the collections made by the Bureau of Ethnology during the field season of 1881, by William H. Holmes. pp. 427–510, figs. 116–200.

Illustrated catalogue of the collections obtained from the pueblos of Zuñi, New Mexico, and Wolpi, Arizona, in 1881, by James Stevenson. pp. 511–594, pls. XL–XLIV.

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Pictographs of the North American Indians. A preliminary paper, by Garrick Mallery. pp. 3–256, pls. I–LXXXIII, figs. 1–209.

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Seventeenth annual report of the Bureau of American Ethnology to the secretary of the Smithsonian institution 1895–'96 by J. W. Powell

director in two parts Part 1 [–part 2] [vignette] Washington Government printing office 1897

In press.

Eighteenth annual report of the Bureau of American Ethnology to the secretary of the Smithsonian institution 1896–'97 by J. W. Powell director In two parts Part 1 [–part 2] [vignette] Washington Government printing office 189–

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BULLETINS

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Department of the Interior U. S. geographical and geological survey of the Rocky mountain region J. W. Powell in charge—Contributions to North American ethnology volume I [–VII, IX]—[seal of the department] Washington Government printing office 1877 [–1893.]
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Observations on cup-shaped and other lapidarian sculptures in the old world and in America, by Charles Rau. [1882.] 112 p., 61 fig.

On prehistoric trephining and cranial amulets, by Robert Fletcher, M. R. C. S. Eng. Act. asst. surgeon U. S. army. [1882.] 32 p., 9 pl., 2 fig.

A study of the manuscript Troano, by Cyrus Thomas Ph. D. with an introduction by D. G. Brinton M. D. [1882.] xxxvii, 237 p., 9 pl., 101 fig.

VOLUME VI, 1890 [1892]:

The Ɠegiha language, by James Owen Dorsey. xviii, 794 p.

VOLUME VII, 1890 [1892].

A Dakota-English dictionary, by Stephen Return Riggs, edited by James Owen Dorsey. x, 665 p.

VOLUME VIII:

[NOTE—As announced in the List of Publications issued as Bulletin x=24, it was the intention to publish Professor Holmes' memoir on "Pottery of Eastern United States" as Volume VIII of the *Contributions*, but as the act of January 12, 1895, failed to provide for the completion of this series, the eighth volume in all probability will not be published.]

VOLUME IX, 1893:

Dakota grammar, texts, and ethnography, by S. R. Riggs, edited by James Owen Dorsey. XXXII, 239 p.

INTRODUCTIONS

(All of the volumes of this series are out of print)

(1). Introduction to the study of Indian languages, with words, phrases, and sentences to be collected. By J. W. Powell. [Seal of the Department of the Interior.] Washington: Government printing office. 1877.

4°. 104 p., 10 blank leaves.

Second edition as follows:

(2). Smithsonian institution—Bureau of Ethnology J. W. Powell, director—Introduction to the study of Indian languages with words, phrases and sentences to be collected—By J. W. Powell—Second edition—with charts—Washington Government printing office 1880

4°. xi, 228 p., 10 blank leaves, kinship charts I–IV in pocket. A 16° "alphabet" of 2 leaves accompanies the work.

(3). Smithsonian institution—Bureau of Ethnology—Introduction to the study of sign language among the North American Indians as illustrating the gesture speech of mankind—By Garrick Mallery, brevet lieut. col., U. S. army—Washington Government printing office 1880

4°. iv, 72 p., 33 unnumbered figs.

(4). Smithsonian institution—Bureau of Ethnology J. W. Powell, director—Introduction to the study of mortuary customs among the North American Indians—By Dr. H. C. Yarrow act. asst. surg., U. S. A.—Washington Government printing office 1880

4°. ix, 114 p.

MISCELLANEOUS PUBLICATIONS

(All of the volumes of this series are out of print)

(1). Smithsonian institution—Bureau of Ethnology J. W. Powell, director—A collection of gesture-signs and signals of the North American Indians with some comparisons by Garrick Mallery. Brevet lieut. col. and formerly acting chief signal officer, U. S. army—Distributed only to collaborators—Washington Government printing office 1880

4°. 329 p.

NOTE—250 copies printed for use of collaborators only.

(2). Smithsonian institution—Bureau of Ethnology J. W. Powell director—Proof sheets of a bibliography of the languages of the North

American Indians by James Constantine Pilling—(Distributed only to collaborators)—Washington Government printing office 1885
4°. XL, 1135 p., 29 pl. (facsimiles).

NOTE—Only 110 copies printed for the use of collaborators, 10 of them on one side of the sheet.

It was the intention to have this Bibliography form Volume X of "Contributions to North American Ethnology," but the work assumed such proportions that it was deemed advisable to publish it as a part of the series of Bulletins, devoting a Bulletin to each linguistic stock.

(3). [Linguistic families of the Indian tribes north of Mexico with provisional list of the principal tribal names and synonyms.]
16°. 55 p.

NOTE—A few copies printed in 1885 for the use of the compilers of a Tribal Cyclopedia and Synonymy now in preparation. It is without title-page, name, or date, but was compiled from a manuscript list of Indian tribes by James Mooney.

(4). [Map of] Linguistic stocks of American Indians north of Mexico by J. W. Powell. [1891.]

NOTE—A limited edition of this map, which forms plate I of the Seventh Annual Report, was issued on heavy paper, 19 by 22 inches, for the use of students.

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ACCOMPANYING PAPERS

PRIMITIVE TREPHINING IN PERU

BY

MANUEL ANTONIO MUNIZ, M. D.,

AND

W J McGEE

PREFATORY NOTE

During several years prior to 1893, Dr Manuel Antonio Muñiz, some time Surgeon-General of the Army of Peru, traveled extensively through the ancient land of the Incas, and made large collections from the huacals and scattered graves of the Andean valleys and the desiccated Piedmont zone inclining from the Cordillera toward Pacific ocean. Lowland Peru is arid, and even the rugged highlands fronting the Pacific receive but limited rainfall; and by reason of a combination of conditions the air and so the soil are dry nearly all the year, and in some places the ground is saline or nitrous. Accordingly organic matter buried in the earth is preserved in a manner hardly conceivable to those accustomed to the conditions of humid lands; and thus Dr Muñiz' explorations were remarkably fruitful.

The material collected from the long-neglected tombs of Peru by Dr Muñiz comprised weapons of war and the chase, implements in wide variety, domestic utensils, costumery of skins and stuffs, and articles of adornment, all in considerable quantity; though his tastes and training led him to devote especial attention to the somatic remains of the ancient people. His collection comprised something over a thousand crania; of these, nineteen were found to be trephined, several more than once.

In 1893 Dr Muñiz attended the "International Congress of Anthropology of the World's Congress Auxiliary of the World's Columbian Exposition" at Chicago, for the purpose of exhibiting and describing the trephined crania. His formal communication, translated into English, forms the accompanying "summary statement." Afterward he attended the Pan-American Medical Congress at Washington, and exhibited the collection informally; and still later he transferred its custody to the writer, on behalf of the Bureau of American Ethnology, for use in preparing the accompanying description of the remarkably interesting series of specimens of primitive surgery.

On his return to Lima, toward the end of 1893, Dr Muñiz had the misfortune to encounter a political movement; before it ended his house was sacked and burned, his library and his rich collections were destroyed, and he was exiled. Of all of the archeologic material brought together during his years of labor, only the collection of trephined crania remains; and the energetic collector has insured the safety of this remnant by

transferring it to the Bureau of American Ethnology for preservation in the United States National Museum, save for a single specimen (the triple-trephined cranium, from Cuzco) which has been placed in the United States Army Medical Museum.

The Muñiz crania have been examined by many scientific and medical men in the United States; since they were brought before the World's Congress at Chicago and the members of the Pan-American Congress at Washington, they have been exhibited and discussed before the Anthropological Society of Washington, the Archeological Association of Philadelphia, the Medical Society of the District of Columbia, Washington, and the Historical Club of Johns Hopkins Hospital, Baltimore; and in addition they have been inspected by many visitors to the Bureau. The accompanying description has been prepared in the light of much discussion concerning the collection, and is framed to answer, so far as may be, the principal inquiries made by students. As originally made, the collection of trephined crania was supplemented and illumined by the collateral objects representing the arts of the primitive trephiners; but since the remainder of the collection is, unhappily, lost irretrievably, it has been deemed desirable so to extend the description and discussion of the crania and the details of the operation as to render the series self-explanatory in every respect. It may, however, be noted that the inferences as to methods and motives are in precise accord with the testimony of associated objects. For purposes of comparison, illustrations of the "Inca skull" brought from Peru by the late E. G. Squier, and of eight trephined crania preserved in the Municipal Museum at Cuzco, are introduced. A more exhaustive discussion of primitive trephining in Peru by Dr Muñiz may be looked for in the future.

For the arduous duty of making the collection and establishing the authenticity of the specimens through careful study of associations, and for the accompanying summary statement, Dr Muñiz deserves the credit and bears the responsibility; for the remaining portion of the paper and for the fidelity of the illustrations the writer is responsible. The respective authorial responsibility is indicated specifically by initials in the list of contents and in the principal subtitles.

W J M.

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PRIMITIVE TREPHINING IN PERU

By Manuel Antonio Muñiz, M. D., and W J McGee

SUMMARY STATEMENT

(M. A. M.)

Much has been written on prehistoric trephining, and it is a well-understood fact that in the ancient villages of this and of the Old World, and even in some of the settlements of the present savages, trephining has been known and practiced, not only for religious purposes but also for surgical purposes, to effect a cure of disorders consequent on traumatic lesions of the cranium and also as a means of treating certain cerebral diseases.

Therefore the historico-bibliographic matters with which every archeologist is perfectly well acquainted may be omitted.

If we take into account the class of offensive weapons used by the ancient Peruvians in their terrible conflicts, almost hand to hand, it will easily be comprehended that complex fracture of the skull with depression of its bony plates must have been very common. In fact, they were accustomed to throw stones of more or less round or irregular shape to great distances with high initial velocity by means of the sling; they were also armed with large wooden clubs, extremely hard, in the ends of which splints of copper or stone were fastened, as well as hatchets of both these materials and of diverse forms.

Without treating of the order in which the different civilizations of ancient Peru were developed and gained predominance, it may only be observed that it is certain the aborigines possessed advanced medical knowledge, making use of a magnificent flora, full today of secrets to us. They knew how to reduce luxation effectively, and employed fixation to consolidate fractures, sometimes having recourse in both cases to kneading (massage); they knew the dangers of free exposure of wounds to the air, curing these very thoroughly; they could easily distinguish syphilis, rheumatism, ague, fevers, cerebral disturbance, mental aberration, etc. Fragments of flint sharpened to a point were used for bleeding and excising pterygiums, and the same sharpened on the

edge for cutting the umbilical cord. Lastly, they possessed a perfect process of mummification. It does not therefore seem strange, surgical science being so advanced in prehistoric Peru, that on the presentation of a broken skull they should attempt first to extract the fragments of bone, to raise and draw out successively the sunken plates, to adjust the points, and, in a word, with their primitive instruments, as primitive as those of ancient Greece and Persia, to accomplish the linear readjustment of the edges of the fracture, forming a quadrangular or polygonal orifice. After this they could easily make the orifice circular or ellipsoidal, etc, by means of strong chisels or *estiletes* of copper, silver, gold, or *champi* (a mixture of gold, silver, and copper, the only metals known to them); also an instrument called *tumi*, which consisted of a blade, straight or curved like a crescent, edged and furnished with a short central haft in the form of a T, together with knives and lances of obsidian.

It would be an extensive undertaking to attempt an analysis of this subject, and, indeed, the last works of Fletcher, Mantegazza, Mason, Wyman, and Munro have saved me the task.

Now, at first sight, or by examination with the lens, it is possible to distinguish cranial perforations due to a pathologic operation from those which have been made artificially. The difference is obvious and very clear. But it has been supposed that when they were not pathologic perforations they were post-mortem operations. I repeat, it is not difficult to know whether the bone has been separated while the individual was living and whether he survived the operation; the length of time could even be determined approximately. There are histologic features which a lens discloses and which will prove without a shadow of doubt the survival of the individual. Moreover, the exaggerated veneration of the ancient Peruvians for their dead completely disproves the supposition, which has been advanced in regard to some other countries or peoples, that trephining was performed only for the purpose of procuring amulets consisting of segments of bone extracted after death from persons noted for valor, intelligence, or virtue. This profanation, if we may so call it, of the bodies of the dead was impossible in ancient Peru, and this fact is proved, since to this day there has never been found any fragment of human bone which could have been used as an amulet.

While forming my collection of ancient crania, seeking them in the various provinces of Peru, I have succeeded in making the collection of trephined crania illustrated in the accompanying plates. I have not attempted for the present to make a craniometric study of them, and take into consideration only the different forms of trephining employed, some of which have not been recognized up to the present time in publications on this subject.

The well-known cranium of Squier was found in the valley of Yucay, near Cuzco, and in the districts adjoining this city, the metropolis of the ancient Inca empire, were found those numbered 7, 10, 12, 13, and 18 in

the accompanying description, which demonstrate the fact that in these localities trephining was not exclusively of the square form, but that other forms also were employed.

In the environs of Lima, more than a thousand miles from Cuzco, I discovered crania 1, 2, 4, 5, 6, 8, 9, 14, 15, 16, and 19, within a radius of 60 miles, in the province of Huarochiri, which is covered with pre-Columbian ruins.

The cranium numbered 17 was discovered in Tarma, in the central part of Peru; cranium 11 in the important ruins of Pachacamac in the neighborhood of the ocean, 15 miles south of Lima. Cranium 3 was found in the ruins of Cañete.

I should observe that up to the present time no trephined crania have been discovered at the famous necropolis of Ancon.

All these skulls, some taken from caves, pertain to a period at least two hundred years anterior to the discovery by Columbus.

Résumé

1. Trephining as a surgical operation was employed in pre-Columbian Peru in various pueblos and at divers latitudes.

2. Different methods of operation were employed as the segments extracted were of different shapes—square, polygonal, circular, oval, etc.

3. There are found crania which show that the individual succumbed immediately or a short time after the completion of the operation; others are found which indisputably prove the survival of the person subjected to the operation.

4. It is almost impossible to accept for ancient Peru the idea of post-mortem trephining, the numerous other examples of cranial perforation being probably of pathologic origin.

DESCRIPTION AND DISCUSSION OF THE PERUVIAN CRANIA

(W. J. M.)

THE COLLECTION

The Muñiz collection comprises 19 trephined crania out of a little over 1,000 specimens; i. e., almost exactly 2 percent of the crania of the collection were trephined. Neglecting a few doubtful cases of repetition, three specimens display two and a third three distinct operations performed at different periods and generally on different parts of the cranium. There are thus twenty-four clear cases of trephining out of 1,000 specimens, or a percentage of about 2.5.

Two of the crania are fragmentary; the other 17 nearly or quite entire. Four were mummified so completely that the desiccated soft tissue remains, despite accidents of exhumation and transportation; most of the others were mummified also, though the tissues have now disappeared; in two or three cases the bone was bleached, and in two others deeply corroded, when found. Most of the thousand skeletons, including those yielding the trephined crania, were exhumed from light and dry sandy, and often nitrous, soil; others were found in caves and rock shelters or on the surface of the ground.

Classed geographically, eleven of the trephined specimens were found in the province of Huarochiri, chiefly in the environs of Lima; one specimen was found in Tarma, another in Pachacamac, not far from Lima, and still another in the province of Cañete; these fourteen specimens representing western central Peru and the more arid piedmont and coastal region. Five specimens were found in the vicinity of Cuzco, in the southeastern and highly mountainous part of the country.

Arranged in the order of description, which in the main is that suggested by character of operation, the crania are as follows:

1. Semimummified cranium from Huarochiri; operation by rectilinear incision (plates I, II).

2. Semimummified cranium from Huarochiri; operation by rectilinear incision (plates IV, V).

3. Weathered cranium from Cañete; operation by rectilinear incision (plates VI, VII).

4. Bleached cranium from Huarochiri; operation by compound rectilinear incision (plates VIII, IX).

5. Semimummified cranium from Huarochiri; operation by multiple rectilinear incision (plates X, XI).

6. Fragmentary cranium from Huarochiri; operation by curvilinear incision (plate XII).

7. Bleached cranium from Cuzco; two operations by curvilinear incision (plates XIII–XV).

8. Fragmentary cranium from Huarochiri; operation by circular incision (plate XVI).

9. Slightly bleached cranium from Huarochiri; operation by curvilinear incision and rasping (plates XVII, XVIII).

10. Ocher-stained cranium from Cuzco; operation by rasping or scraping (plates XIX, XX).

11. Bleached (distorted) cranium from Pachacamac; operation by curvilinear incision and rasping (plates XXI, XXII).

12. Semimummified cranium from Cuzco; two operations, by curvilinear incision and scraping, respectively (plates XXIII, XXIV).

13. Weathered cranium from Cuzco; two operations, by (?) curvilinear incision and rasping (plate XXV).

14. Mummified cranium from Huarochiri; unfinished operation by compound incision (plates XXVIII, XXIX).

15. Mummified cranium from Huarochiri; unfinished operation by compound incision and elevation (plates XXX–XXXII).

16. Mummified cranium from Huarochiri; unfinished operations, by rectilinear incision and by rasping (plates XXXIII, XXXIV).

17. Mummified cranium from Tarma; operation by rasping, with incomplete operations by incision (plates XXXV, XXXVI).

18. Semimummified cranium from Cuzco; three operations, by (?) curvilinear incision and rasping (plates XXXVII, XXXVIII).

19. Semimummified cranium from Huarochiri; operation by incision and rasping, supplemented by plate (plates XXXIX, XL).

The crania are represented on the plates indicated by photomechanical (half-tone) reproductions from photographs, mostly by Hillers, with a few by Dinwiddie, on a scale reduced to two-thirds linear of the natural size.

TREPHINING IN GENERAL

DISTRIBUTION

Trephining is a fairly common operation in modern surgery. Essentially it consists in the removal of a small section from one of the bones of the skull, usually in the form of a circular button or rondelle. Ordinarily the operation is performed by means of a trephine, or annular saw, supplemented by a few other instruments of simple character, including elevators, stout forceps, etc, together with the usual appliances for making and closing the attendant incisions in the scalp. In some cases the button is restored, either entire or broken up; in other

cases it is replaced by a plate of silver or other substance; sometimes the aperture is left and covered only by the scalp.

The operation is employed in certain cases of depressed fracture or other traumatic lesions of the cranium, and in cases of intra-cranial tumors or suppuration; it is also employed for epilepsy, and more rarely as a prophylactic, or to gain access to the intra-cranial tissues for local treatment.

By most practitioners trephining is regarded as a serious or even desperate operation, and is resorted to only in grave cases. According to Bluhm's statistics, covering nearly 1,000 cases, the mortality exceeds 50 percent, most of the cases being of course complicated by the original lesion. The risk is better determined from the operations for epilepsy without antecedent traumatic conditions; of these cases 16 out of 72 collected by Billings and 28 out of 145 collected by Echeverria, or a mean of 20 percent, proved fatal, though some practitioners, using special precaution against sepsis and avoidable injury to bone and tissues, have obtained better results, one operator recording a mortality so low as 1 out of 30 cases.

Trephining is occasionally employed in the treatment of disorders among domestic animals, though not so much by trained veterinarians as by rude herdsmen possessing little knowledge of anatomy and less of etiology, and imbued with fantastic notions concerning the effect of the operation; e. g., it is performed on sheep and swine with the notion of rupturing a supposed bubble or bladder beneath the skull, or extracting a grub or worm from the brain of the animal, and thus relieving a mysterious disorder. In such cases the operation is commonly performed in rude fashion, perhaps with carpenter's tools, a chisel and mallet, and even an auger being sometimes employed. Not infrequently the animal survives, and in some cases appears to be benefited.

Among certain primitive peoples trephining is practiced, sometimes with astonishing frequency. The Kabyle, a nomadic and essentially autochthonous tribe of Algeria, resort to trephining not only in traumatic lesions of the head, but for neuralgia, vertigo, and various other disorders. The operation is performed rudely, either with such tools or implements as may chance to be at hand, or with crude metallic saws, perforators, and elevators designed for the purpose.[1] Ordinarily the aperture, which is frequently large and usually irregular, is closed by a plate, though it is often left open and covered only by the scalp. The frequency of the operation indicates that the mortality can not be very high, and one observer saw men who had survived five or six operations at different periods and for different injuries. The operator is a hereditary shaman or priest, and the operation is, at least in part, thaumaturgic; the methods are clumsy, painful, and tedious, yet the victim glories in his undemonstrative endurance of the ordeal.

[1] "On Prehistoric Trephining and Cranial Amulets," by Dr Robert Fletcher, in Contributions to North American Ethnology, vol. v, 1882, p. 25 et seq.

Trephining is well known among certain savages. For example, the South Sea islanders were, when first seen by white men, acquainted with the operation, which was performed by scraping with a flint implement, a shark tooth, or (after contact with the whites) a piece of broken glass. The aperture was commonly covered with a carefully prepared piece of cocoanut shell. The purpose was to relieve headache, neuralgia, vertigo, and the like, yet the operation appears to have been essentially thaumaturgic. The mortality has been estimated at 50 percent, yet the treatment is said to have been so common in early days that most of the male adults had undergone one or more operations.

Even in prehistoric times trephining was not uncommon in various parts of the world, as has been shown by Broca, Prunières, and others in Europe, and by Fletcher and some other investigators in this country. While there are indications that the motives varied, satisfactory evidence has been adduced to show that prehistoric trephining, particularly in Europe, was essentially thaumaturgic, and that in many cases the operation was post-mortem and designed to yield rondelles for use as amulets. The instruments used in removing the rondelle were those pertaining to the current cultural stage.

Thus the distribution of trephining with respect to time, territory, and culture-grade shows that the operation is common to several countries and to all stages in the development of mankind from the unwritten past to the present and from savagery to civilization, and that the methods and motives have varied widely with cultural progress.

CLASSIFICATION

The operation of trephining, as performed by different peoples in the several culture stages, may be regarded from different points of view, and so classed in different ways:

Classed with respect to period, the operation may be considered as (1) *prehistoric* and (2) *modern*.

Classed with respect to the methods employed, trephining may be considered as (1) *primitive* and (2) *specialized*. Primitive trephining may be defined as that performed by means of implements or tools either undifferentiated or specialized for other functions; specialized trephining may be defined as that performed by means of instruments designed and made for the purpose. Under these definitions, primitive trephining comprises all the known prehistoric operations, the operations performed by the South Sea islanders, and the rude, rural trephining of domestic animals; while specialized trephining embraces not only the highly developed operations of modern surgery, but also such crude operations as those of the Kabyle, when performed by trained shamans with special apparatus. These primary classes are so broad as to be susceptible of subdivision. Accordingly, primitive trephining may be considered as (*a*) *archaic*, or that performed anciently or without knowledge or use of metal, including the prehistoric operations and

those of the South Sea islanders, and (*b*) *neoteric*, or that performed modernly, or by means of metal, including the skilless operations on domestic animals. Commonly, or always, neoteric trephining is accultural, and represents the engrafting of a higher technology on the stock of a lower sophiology. Specialized trephining may in like manner be subdivided into two classes—(*a*) *rude*, or that performed in a simple and barbarous manner by untrained or shamanistic operators without knowledge of physiology, as among the Kabyle; and (*b*) *refined*, or that performed skillfully and intelligently, as by civilized surgeons.

Classed with respect to motive or purpose, trephining may be considered as (1) *thaumaturgic* and (2) *therapeutic*. Thaumaturgic trephining is presumed to act in an occult or mystical way, either for the good of the sufferer or for the benefit of the operator or others; it may be styled (*a*) *vicarious*, when designed to benefit the operator or others, and (*b*) *sortilegic*, when practiced in the interest of the sufferer. Vicarious trephining as thus defined is commonly (so far as known through observation, always) post-mortem, while sortilegic trephining must be essentially ante-mortem. Under these definitions the prehistoric trephining recorded by Broca, Fletcher, and others must have been vicarious, at least so far as post-mortem; while the operations exemplified among the South Sea islanders, and perhaps also among the Kabyle, are sortilegic, and thus occupy a well-marked early stage in the development of medical practice. Therapeutic trephining may be defined as that employed intentionally and intelligently, and without regard to the supernatural, to relieve a disorder; and it may be either (*a*) *empiric*, when it is not, or (*b*) *scientific*, when it is, guided by knowledge of physiology or etiology, one or both.

Trephining may be classed also by the culture-grade of the people practicing it, as (1) *savage*, (2) *barbaric*, and (3) *civilized;* or, more conveniently, as (1) *uncivilized* and (2) *civilized*. This classification crosses, and in a measure corrects, the grouping by period, since it emphasizes the persistence in some countries of characteristics which in other countries existed only during the prehistoric past.

These classes are defined from the standpoint of anthropology rather than from that of surgery or medicine in general; yet their recognition seems essential to comprehension of the origin and development of one of the most remarkable among the triumphs of modern surgery. Their significance is such as to warrant juxtaposition and careful comparison:

Period	Method		Motive		Culture-grade
Modern	Specialized ..	Refined / Rude	Therapeutic...	Scientific / Empiric	Civilized
Prehistoric	Primitive ...	Neoteric / Archaic	Thaumaturgic.	Sortilegic / Vicarious	Uncivilized

On comparing the method classes with the periods and culture-grades, it is found that archaic trephining was chiefly prehistoric and exclusively eodemotic, but that neoteric trephining persists, at least vestigially, among backward representatives of civilized peoples; yet that

in general primitive method coincides with uncivilized culture. In like manner it is found that rude trephining, as displayed typically among the Kabyle, is distinctively above that of the prehistoric period and demonstrates a differentiation of labor and a social organization transcending that of simple kinship, so that it falls logically into the civilized stage, while refined trephining belongs to advanced culture.

When the motive classes are compared with the others, it is found that vicarious trephining is wholly prehistoric so far as present knowledge extends, and that both the vicarious and sortilegic operations are essentially uncivilized, though the sortilegic practice is found in modern times among peoples of the lower culture status. So, too, the vicarious operation was performed by the archaic method, while the sortilegic operation is essentially neoteric, though the thaumaturgic motive outlived the primitive method so far as partially to control the rude operations of the Kabyle class. Similarly the empiric operation is characteristically rude, and in general pertains to the modern period and marks the transition from uncivilized to higher culture, while scientific trephining is modern in period, refined in method, and civilized or enlightened in culture-grade.

These coincidences are too many and too close to be fortuitous, and the classes can be regarded only as indices to the progressive development, if not to the origin, of trephining and of so much of surgery as is involved therewith.

ORIGIN AND DEVELOPMENT

Trephining is one of the boldest operations of modern surgery, rivaling plastic surgery and cœliotomy as a revelation of the ambition and ability of the trained practitioner to explore, modify, re-create, and in every way shape to his liking even the most delicate parts of living organisms. Yet, remarkable as is the modern achievement of specialized trephining, it pales before the marvel of primitive trephining, which is proved by indisputable, though all but incredible, evidence to have been performed habitually and successfully by barbaric and even savage peoples during remote ages. The archeologic and ethnologic records prove not merely the occurrence of the operations in prehistoric times and among various tribes, but indicate that among certain primitive peoples the operation was better known than in modern civilization, more common even than in modern hospitals. Among the Kabyle, students are impressed by the number of individuals who have undergone the operation; among the South Sea islanders, the observers report that nearly every male adult has been trephined once or oftener; and among the prehistoric ossuaries of southern Europe the proportion of trephined crania is strikingly large. Perhaps the best evidence as to the frequency of the operation among the primitive people of the world is that afforded by the Muñiz collection, with its ratio of 2 percent of trephined individuals and 2.5 percent of operations to entire

crania—a ratio probably higher than that of any modern military hospital, and scores or hundreds of times higher than that of the average cemetery of civilization. Most of the bolder operations of recent surgery are of modern invention, many of them reflecting (in successful practice at least) the career of a leader still living, Sir Joseph Lister; but trephining boasts an origin so remote, a lineage so long, an ancestry so eminent, as to claim a special place among the medical arts. It would be difficult to find a more striking illustration of the persistence of a remarkable custom throughout the stages of cultural development than that exemplified in trephining, and the example is of the first importance in illustrating the development of the healing art with which it is connected.

Reviewing the relations epitomized in the table, it may be noted particularly that the practice of trephining has not only outlived the complete transformation in technology which accompanied the passage from stone to metal, but has survived all of the most profound intellectual revolutions in the history of mankind. As a corollary of this striking proposition (which is fully established by the facts summarized in the table), it may be noted particularly, also, that trephining was not originally a curative treatment; indeed, the early practitioners had no conception of real curative or restorative treatment, no glimmering of physiologic or etiologic knowledge, no idea of relation between health and disease, no definite notions concerning the conditions of life and the causes of death. As a scholium to this corollary, it may be particularly noted, finally, that the practice of trephining has survived transformation in motive and has persisted only through the gathering of new motives as knowledge has progressively grown up.

Thus the history of trephining is complex, and it is not easy, from the standpoint of modern knowledge, to perceive how or why the practice was pursued in any generation or in any succession of generations before the development of scientific motives and refined methods. True, it may be stated as a general law—the verity of which is not generally recognized, though it may confidently be affirmed—that, save sometimes in the modern stage of invention, men learn how and why they act only by acting, so that the action precedes its own explanation; yet even this law does not fully elucidate the origin of a peculiar, not to say monstrous, course of action, nor does it clearly indicate how such an operation, visibly accompanied by great suffering and often attended by loss of life, could have originated intelligently or could have persisted even if it originated accidentally. Manifestly the chief difficulty in the way of explaining the origin of trephining grows out of the fact that the operation was discovered and was long practiced before the motives actuating enlightened men were developed; and it follows that search for the origin of the operation can be hopefully conducted only in the light of knowledge of the motives of primitive men. Fortunately the way in which barbaric and savage people think is coming to be understood; and the light thus given illumines fairly, though at some points faintly, the wonderful course of development of the art of trephination.

Primitive men are mystics. In the earliest stage in the development of belief, all objects, but especially the rare and unfamiliar, are supposed to be imbued with mysterious attributes and powers which are exercised capriciously for the good or the evil of the egoistic and egotistic thinker—for magnification of the ego is the leading characteristic of primitive thought. Thus, in this stage, primitive man considers himself surrounded by mysterious potencies, beneficent and maleficent, whose favor is sought by propitiation, which commonly takes the form of fetich-worship, amulet-wearing, and oblation. As this stage in the development of belief advances, the mysterious potencies are segregated; some are regarded as more beneficent or maleficent than others; and the supposed actions of the imaginary powers gradually come to be held as less capricious, more uniform or regular, than at the outset. In the second stage of the development of belief, the mysterious potencies are still further segregated and ascribed mainly to animate or self-moving things, and in time animals, particularly the strong, the swift, and the venomous, are deified. In this stage the veneration of animal totems, the taboo, and other curious customs develop, while amulet-wearing and oblation persist. In this stage, too, inimical men and women, both alien and intern, are assumed to possess mystical powers, and witchcraft and a peculiar fear of and veneration for members and fragments of the human body arise; thus incantation and sorcery through nail-parings, hair-combings, and other parts of the person (the syncedochic magic of Mason), and the wearing of scalps or fingers or teeth of slain enemies, first as charms and later as trophies, grow up as features in formal or ceremonial propitiation of mysterious powers. As this stage advances, the deific animals are presumed to possess supernatural forms as well as powers, and thus the age of dragons and chimeras and goblins and molochs is introduced. In the third stage in the development of belief, the mysterious potencies are so far classified and arranged as to correspond with the powers of nature—the action of sun and moon and stars, of thunder and lightning, of winds, of storm-waves and torrents, of the cold of the north and the winter, etc—and these are personified first as beast-gods and later as anthropomorphic deities. In this stage, incantation and sorcery gradually become incongruous with the developing belief, and either disappear or (under a curious law, exemplified in biology as well as demology, which may be called the *Law of monstrosities*)[1] pass into divination or sortilege, which leads into necromancy or jugglery, such as culminates among the fakirs of India, or grow into

[1] As is well known, when deep-sea fishes are traced downward into the abysmal depths where the light is faint, the eyes of some species disappear, while those of others are abnormally developed; it is also well known that when a flora is traced into the desert, some plants become dwarfed and shrunken with the diminishing moisture, while others develop tumid and pulpy trunks to fit themselves to the changed conditions. In like manner, when a belief outlasts the conditions under which it was developed, it may be either abandoned or modified; in the latter case the modification soon becomes incongruous with the ever-changing conditions, when it is again necessary either to abandon or modify; and thus beliefs tend to develop into persistent extravagancies with respect to both concept and ceremonial. It is needless for the present to trace this tendency in detail or to enumerate the many striking illustrations of the law.

trial by ordeal, as among our own ancestors; yet invocation and sacrifice persist, and amulets retain their hold. By Powell these stages in the development of belief are respectively denominated hecastotheism, zootheism, and physitheism.[1] Some knowledge of these stages in the development of belief is requisite for comprehension of the motives and mental operations of primitive men.

There is a human trait characteristic of all stages of development, and especially prominent in the earlier stages, which bears directly on the discussion of the motives of early men; it results in what may be called the *Law of the development of fable*. The mind is so constituted as to demand explanations; at the same time it is prone to offer and accept the chaff of hypotheses in lieu of the grain of full understanding; and these tendencies are specially prominent in the communion of children and adults. A pertinent illustration of the trait is the development of belief in shades of the departed, which is, in many respects, parallel to the recognition of mysterious potencies or doubles of things in hecastotheism. The hunter dies; the sages of the clan or tribe, warned by experience, forestall dispute concerning future ownership of the favorite weapon by burying it with his body. The children ask why the weapon was buried, and their elders, ignorant of the real reason, say the hunter still has need of it; so the children are strengthened in their notion of mysterious potencies, and think of the hunter as still using his favorite weapon in a mystical hunting ground. But in all stages of development, belief runs a close race against cupidity, and is sometimes distanced; so the sages learn that even a buried weapon may be a source of contention, which they thenceforward forestall by breaking or burning it. Again the children ask why, and the ill-advised elders are put to the further explanation that the broken or burned weapon is none the less serviceable to the dead hunter, since it is thereby changed only as he is changed; so the hypothesis of mysterious shades is strengthened and extended to weapons, and eventually to favorite animals, as well as to the huntsmen and their consorts. In time the easily satisfied children become the sages of their clan or tribe, and lay down simple yet definite laws in accordance with their early notions concerning shades. They are unable to find the shadowy hunting ground, and consequently argue that it must be a long way off, and that the dead hunter must needs be provisioned against the journey; so food and drink are buried or burned with the dead, and the children are regaled with enriched hypotheses; and through the union of natural affection, belief, and ceremonial the lifeless body becomes a doubly mysterious and sacred thing, and, if the stage of development is that of synecdochism, a mysteriously potent thing. This is only one of the ways in which the primitive (and even modern) tendency to explain by half knowledge is developed into motive-shaping belief; the ways are legion.

[1] The subject of primitive belief is developed somewhat more fully in "The Siouan Indians," Fifteenth Annual Report of the Bureau of Ethnology, for 1893–93, (1897) pp. 153–204.

Understanding primitive motives and mental traits, and the modes of thought which they reflect, it is not difficult to discover the origin, or at least a quite early stage in the development, of post-mortem trephining; and it is possible to buttress on this basis a partly hypothetic bridge spanning the chasm between post-mortem vicarious operations and ante-mortem trephining, both thaumaturgic and therapeutic. When, in the stage of amulet wearing and synecdochism, the warring tribesman slew an enemy, he sometimes mutilated the remains and even ate of the heart, not only in savage triumph, but mainly in order that he might gain the courage and strength of his quondam opponent; and partly as a trophy, but chiefly as a mystical talisman and constant invocation to the powers, he appended the scalp to his spear or belt, or strung the teeth in a necklace, or converted the erstwhile powerful hand into a gorget. This stage and custom are well known among the primitive peoples of the earth. Reaching a little way into the unknown from this buttress of the known, it is easy to see that, save perhaps in the driest climates, the indecomposable teeth would be found more satisfactory talismans than the decomposable scalp or hand, and that, through natural association, the durable skull lying just beneath the evanescent scalp of the mutilated body might easily come to be drawn upon for the amulet trophy. This inference lies close to established fact, since it is well known that certain primitive tribes preserve the entire or mutilated heads of enemies slain in battle. It is but another easy step to the stage in which one or more pieces of the skull (for in synecdochism the piece carries the virtue of the whole) of the slain enemy were used as amulets, either as supplementary to or as substitutes for the teeth. Here again the structure of explanation rests on the firm ground of established fact, as revealed through study of the prehistoric; for it is well known that post-mortem trephining was extensively practiced in certain cases during prehistoric times, and that the rondelles obtained thereby were worn and treasured after the manner of amulets. Thus, in this stage, trephining must have been performed with a definite motive, under the zootheistic belief that the slain warrior vicariously strengthened his slayer. It is probable—nay, certain, as archeologic record indicates—that the grisly custom strengthened through exercise and extended to the taking and prizing of amulets from other skulls than those of enemies slain in battle, so that the custom matured in a cult of morbid and revolting character, in which the growing sacredness of the human body under synecdochic mysticism played an important part.

Here a span in the explanation-structure fails, yet the chasm is not too broad and deep for easy crossing on the scaffolding afforded by study of primitive ideation: The keynote to zootheism is the animate power or self-motility of animals, whereby they are exalted above all self-moveless things; and thus to the zootheist, dominated by synecdochism, the talisman taken from the wounded enemy, while still living, was immeasurably more potent than that taken from the dead enemy; and

so it must have been that the well-known ante-mortem mutilation, which on the one hand grew into the scalping of wounded warriors and the appalling torture found among the American Indians as well as among other savages, must have grown on the other hand (when antecedent conditions were favorable) into ante-mortem trephining of wounded and later of woundless captives. When this stage was reached, experience—which taught primitive men as modern men are taught, though much more slowly—must have shown that sometimes the sufferers survived, and were perhaps even improved. Now, if the practice were continued among a given people into that part of the stage of physitheism in which the cult of kismet prevails (as among so many people in the upper strata of uncivilized culture, including the Kabyle, if not the South Sea islanders), the custom of trephining wounded captives would almost necessarily grow up, with the idea that a mystical significance attached to the operation as a sort of ordeal; the idea might be that, if fate so willed, the captive would thereby become the more perfectly affiliated with the captors, while if Allah decreed death under the knife—so mote it be. There is but one short step more to the solid ground of known fact, i. e., the gradual extension of the fatalistic or sortilegic operation from captives to others; and this transition is in accord with known methods of thought among primitive folk belonging to that stage of physitheism or incipient psychotheism in which the ordeal was developed; for it was quickly perceived among many peoples that if the ordeal was beneficent to one class it could not be devoid of good when extended to other classes. Here again the structure of explanation rests on the firm ground of observation; for the typical trephining of the South Sea islanders, and in large measure the typical Kabyle operation, represent the general sortilegic stage in the development of trephining.

The span of the explanation-structure extending from sortilege to empiricism is long but well supported; for while the transition from purely fatalistic treatment of the sick to empiric treatment of disease was slow among each people, its course has been well observed. Gradually the mysticism, the belief in occult power, waned; gradually the recognition that given treatment (howsoever random) was followed by fairly uniform results waxed. Thus the doctrine of signatures grew into simple therapeutics; thus the belief in blind fate grew into belief in the kingly touch; and thus dimly realized experience of the uniformity of cause and effect made medics out of hermits and beldams and chemists out of alchemists, and in time made nurses and neighborhood practitioners out of sedate and observant men and women. With the tedious revolution in medicine went a slow transformation in surgery, and the shamans and their descendant doctors gradually forgot the ordeal motive, and trephined men and animals in desperate cases because their teachers had done so—and were they not wise men?

The span from empiric treatment of disease to scientific medicine and surgery is not long, and is covered in the history of every civilized

country, and indeed by the range of current thought in America and Europe. Practitioners, like other men, first learn how and then learn why to act through action; the zealous physician scans memory and record of cases in the effort to find a treatment which gives promise of saving his patient; he can not forget trephining, for the records are full of it, his clientele remind him of it, and his rural neighbor perchance practices it on his beast. He can and does weigh the risk as shown by the results of empiric practice; he can and does consider the physiologic conditions and etiologic bearings of the operation; and in the end the operation is performed or not, as the best judgment of practitioner or consultation may decide. Yet in every case the decision is based largely on the record, and the treatment, if adopted at all, is adopted largely if not mainly by reason of empiric experience rather than by reason of etiologic considerations; indeed, the layman may well question whether the desperate operation of trephining (in contradistinction from simple elevation or extraction of bony fragments in case of depressed fracture) would have been introduced before plastic and intestinal surgery had it not come down from the prehistoric past, a legacy from the darkest ages.

In this way the genesis and development of one of the most remarkable features of medical practice may be traced with a fair if not high degree of certainty. The explanation seems safe, because it rests on well-established fact at many points; it seems just, because it is in close accord with all that is known of the evolution of methods and motives among men. The course of development thus traced is not only of interest in itself and in its bearings on the trephining of Peru, but is of much significance in its relation to the development of other branches of surgery and medicine.

It remains to interpret the Muñiz collection in the light of the history of trephining as thus outlined, and then to consider the facts revealed in this collection as bearing on the history.

THE CRANIA IN DETAIL

Common Features

Collectively the crania are notably small and variable in form, as indicated by the illustrations, which depict different aspects on a scale of two-thirds linear. With one possible exception, all are adult and some fully mature, as indicated by the condition of the sutures. Considered collectively the cranial bones are remarkably thick and strong, only one or two of the specimens approaching the Caucasian normal in respect to thinness. The tendon and muscle attachments are notably prominent, rugose, and striated, indicating vigorous physical development. In several cases the supernumerary interparietals known to archeologists as "Inca bones" are found. In one fully adult specimen the metopic suture is distinctly preserved; and in general the sutures, especially the lambdoid and the posterior portion of the sagittal, are remarkably crenulate.

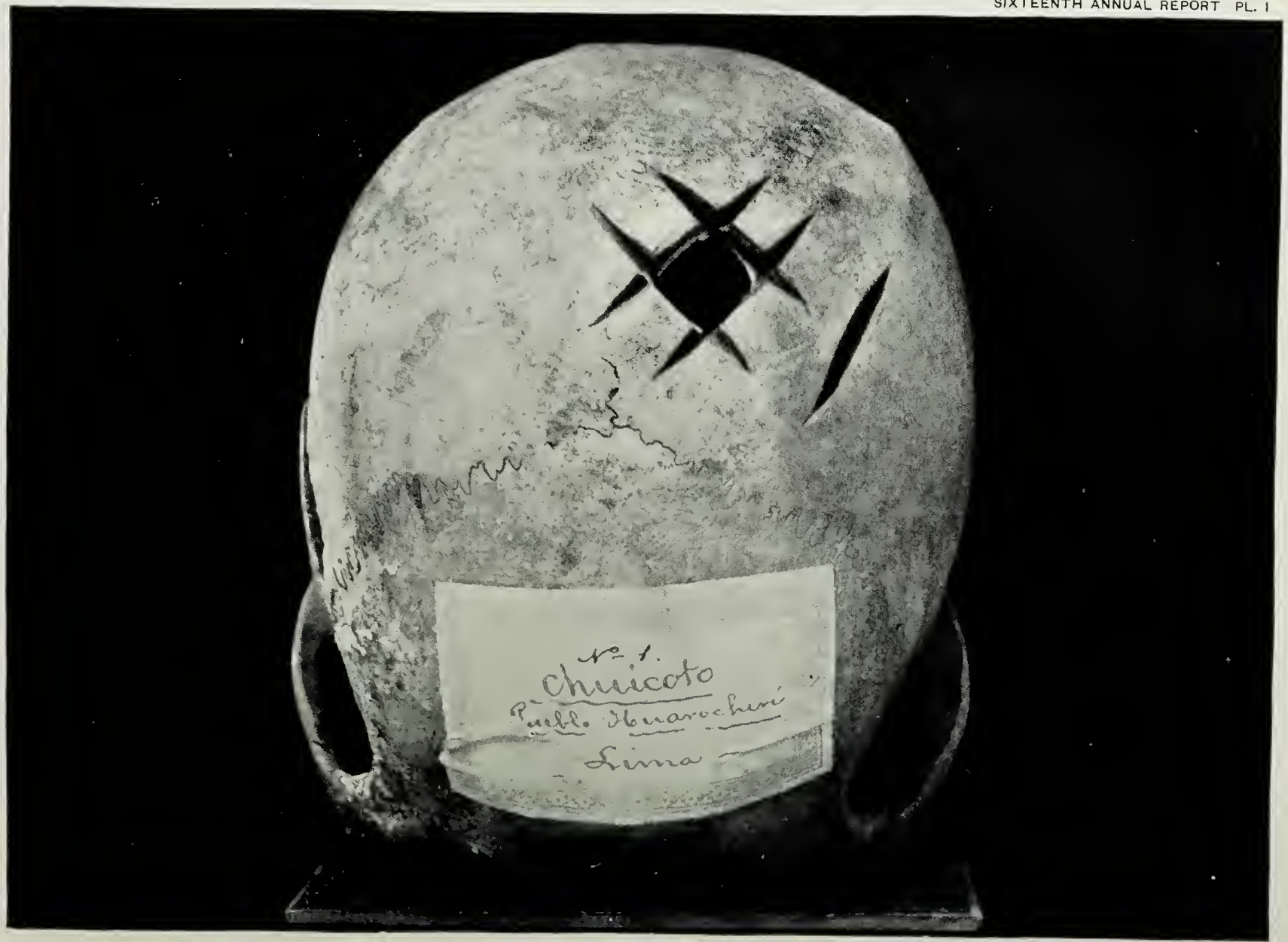
CRANIUM 1

(Plates I, II)

Excepting a spot on the right side, which is somewhat weathered and eroded through exposure, this skull is firm, strong, and exceedingly well preserved. It was taken from a semimummified body, and shreds of tissue remain attached. It displays a single operation, so far completed as to reveal the methods pursued by the primitive practitioner with remarkable clearness, together with an incomplete supplementary incision. The thickness of bone, measured on the incisions, is 6 to 7 mm. The condition of sutures and teeth indicates mature but not advanced age.

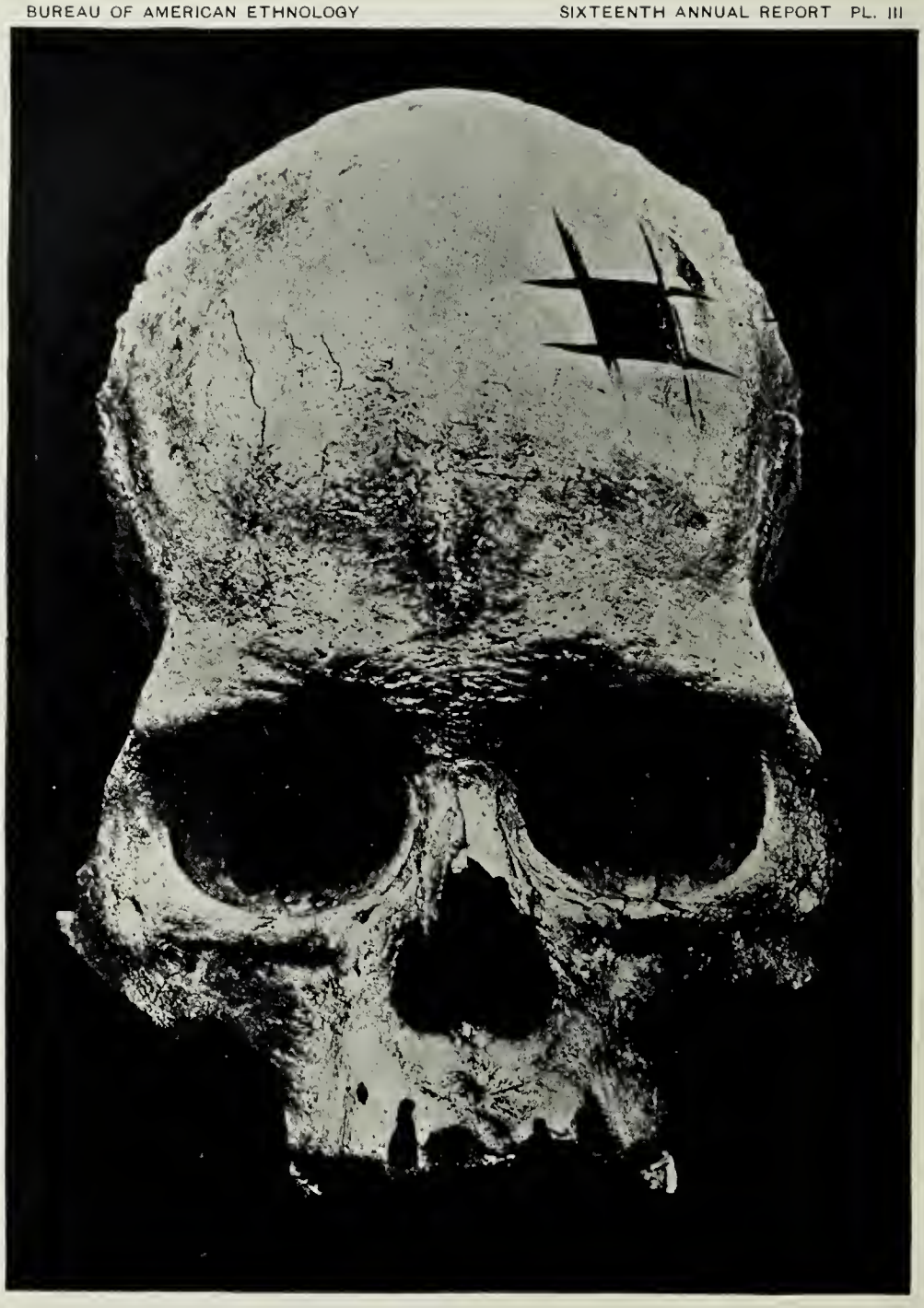
The operation was located near the crown, i. e., in the upper and forward part of the left parietal, involving the sagittal suture and approaching the frontal. The aperture is an approximate parallelogram, averaging 17 by 22 mm., measured on the outer surface, and about 2½ mm. less, in either dimension, measured on the inner surface. As clearly shown by the projecting extremities, the rectangular button was dissevered by means of two pairs of approximately parallel incisions, crossing approximately at right angles. All of the incisions were more extended than the aperture, ranging from 42 to 50 mm. in length. The incisions are V-shape in cross-section; none end abruptly, but simply narrow and shallow to the points of termination. The two more nearly longitudinal incisions are sharply defined quite to the termini, though there is a minor cut nearly parallel to the medial cut (shown in plate I), indicating a change in position and direction of the incision early in the operation. The lateral extremities of the transverse incisions are somewhat indefinite, showing a number of scratches and cuts produced by slips or clumsy manipulation of the instrument. (These marks are imperfectly reproduced in the plates.) All four of the principal incisions penetrated both tables of the skull for a part of their length, both the transverse cuts (especially the posterior one) passing beyond the medial longitudinal incision in such manner as to show that the intracranial tissues must have been injured by the operation; while at the latero-posterior angle the rudely executed incisions did not extend quite through the inner table, and a projecting edge of bone remains, suggesting that the button was removed by the use of an elevator inserted at the medio-anterior corner.

There is no indication of effort to smooth the sharp edges left by the cutting, nor is there any indication of subsequent growth. Moreover, there is some discoloration of the bone about the incision, indicating incipient decomposition in advance of mummification. Accordingly it seems probable that the individual did not survive the operation—indeed the posterior transverse incision must have penetrated the meninges and invaded the cerebral tissue for a length of 12 mm. and a depth and width of 2 or 3 mm., and must have produced or hastened death.



SUPERIOR ASPECT OF CRANIUM 1, FROM HUAROCHIRI

LEFT LATERAL ASPECT OF CRANIUM 1



ANTERIOR ASPECT OF SQUIER'S "INCA SKULL"

The supplementary incision is about 20 mm. below the aperture, near the center of the anterior part of the left parietal, and nearly parallel with the more nearly longitudinal incisions of the principal operation. It is precisely like the main incisions, V-shape in section, 42 mm. long, 5 mm. wide, and 6 mm. deep toward the center, where it does not quite penetrate the inner table of the skull, narrowing and shallowing gradually toward the extremities. Just below its center there is a transverse scratch (hardly visible in the plate), apparently marking a transverse incision barely started when this part of the operation was abandoned. There is a similar faint scratch back of the main aperture, between and behind the main longitudinal incisions, and approximately parallel with them, which appears in the reproduction.

The preservation of the specimen is so perfect as to reveal even the faintest scratches produced in connection with the operation, and thus to indicate the character of the instrument and the mode of its use. The scratches, both random and at the ends of some of the incisions, show that the instrument had a single moderately sharp point, thickening rapidly to 3 or 4 mm. within 6 or 7 mm. from the tip; that not only the point but the sides bit into and ground away the bone as it was manipulated; and that the manipulation could only have been a reciprocal motion back and forth from end to end of the incision, accompanied by considerable pressure. It is noteworthy that no known metal instrument or implement would produce the general and special features of the incisions in this cranium, while all the features of incisions and scratches are precisely such as would be produced by a sharpened stone in the form of a spearhead, arrowpoint, or knife.

In addition to the operation and supplementary incision, the cranium displays a few significant marks. The most conspicuous of these is almost exactly in the center of the frontal bone, some 40 mm. above the orbital ridges; it is a narrow, longitudinal contusion, 20 mm. in length, along which the bone is crushed irregularly, in such manner as to indicate impact of a moderately sharp but rough-edged instrument, the force of impact being such as to produce a curvilinear crack in the outer table, nearly parallel with the contusion, and joining it at the ends. The appearance of this lesion indicates that it was produced during life, though there are no marks of reparative process. Near the left margin of the frontal bone, some 50 mm. above the left orbit, there are two deep grooves 2 or 3 mm. wide and 15 mm. and 20 mm. long, respectively, partly obliterated by reparative process, evidently marking old wounds. (The three marks are concealed beneath the label.)

For comparison with the Muñiz specimens, a photomechanical reproduction of the "Inca skull," brought from a cemetery in the valley of Yucay, Peru, by E. G. Squier, is introduced in plate III, from a photograph taken in the United States Army Medical Museum.[1] The oper-

[1] A wood engraving from this photograph forms plate VII of Dr Fletcher's memoir "On Prehistoric Trephining and Cranial Amulets," cited above. A wood engraving of the same skull appears on p. 457 of Squier's "Peru—Incidents of Travel and Exploration in the Land of the Incas."

ation displayed by this specimen is precisely similar to that exemplified in cranium 1 of the Muñiz collection; the aperture is 0.58 inch by 0.70 inch. The Squier specimen shows (obscurely in the accompanying plate) the extent of the removal of the periosteum. It was examined by Broca, who thought this was done eight or ten days before death, and by Nelaton, who suggested that the subject might have survived fifteen days.[1]

CRANIUM 2

(Plates IV, V)

This specimen, like the last, is finely preserved and strong, and bits of stout tendon remain attached. The frontal and temporo-parietal sutures are nearly anchylosed, though the lambdoid is distinct (showing several supernumeraries), indicating, on the whole, full maturity. The specimen shows a single operation, about which the bone is 5 or 6 mm. in thickness.

The operation was located near the posterior angle of the right parietal, approaching both the sagittal and lambdoid sutures. As in the first cranium, an approximately rectangular button was dissevered by means of two pairs of parallel incisions. The aperture is remarkably small, averaging 9 by 10 mm. measured on the outer surface and considerably less measured on the inner surface. The incisions are V-shape in section and project beyond the aperture, though much less than in the first specimen; the longitudinal incisions are the longer, measuring about 26 and 35 mm., respectively, and show random scratches toward the posterior extremities; the transverse incisions are only 16 or 17 mm. in length, barely crossing the transverse incision on one side and projecting but 4 or 5 mm. on the other. The incisions, like those in the first specimen, show every indication of having been made by a single-point, tapering instrument, so constructed as to abrade on the sides as well as at the tip; they are much too wide and too strongly curved in plan and section to permit the supposition that the instrument was metal, and are just such as would be produced by a stone tool. The operation would appear to have been more skilfully performed than the last, since the incisions are much shorter in proportion to their depth, and so placed as to involve a minimum expenditure of labor and suffering, in view of the rude character of the instruments employed. Two of the incisions only appear to have penetrated the bone, and the rough edges of the inner table remaining indicate that an elevator was applied to break out the button so soon as the bone was sufficiently attenuated, while the superior and lateral kerfs evidently penetrated not only the inner table but the meninges. There is no sign of smoothing of the sharp edges of the bone after the operation, nor is there any trace of reparative growth to indicate survival; moreover, there is some local discoloration of the skull suggesting local decomposition before mummification. In addition, the bone, for some distance about

[1] Pern, op. cit., 577.

POSTERIOR ASPECT OF CRANIUM 2, FROM HUAROCHIRI

RIGHT LATERAL ASPECT OF CRANIUM 2

SUPERIOR ASPECT OF CRANIUM 3, FROM CAÑETE

RIGHT LATERAL ASPECT OF CRANIUM 3

the point of operation, displays a somewhat corroded and spongy appearance, indicating an abnormal condition during life, probably periostitis. Thus there is a suggestion that the operation was antemortem, and connected with a diseased condition; and there are indications that the sufferer did not survive the treatment.

This cranium displays also a few marks apparently due to old contusions or wounds, nearly obliterated by reparative process; the most conspicuous are clearly shown in the reproductions on the right and left of the operation in a somewhat higher horizontal plane (these may be pathologic); and there is a long vertical groove over the left temple.

Cranium 3

(Plates VI, VII)

This specimen is much weathered and eroded, no trace of tissue remains, and the weaker bones and processes are fragmentary or absent. The condition of the sutures indicates maturity. A single operation is displayed, revealing a thickness of bone varying from 5 to 7 mm.

The operation was performed on the right side of the crown, i. e., near the middle of the upper margin of the left parietal, apparently just involving the sagittal suture. While the condition of the skull is not such as to indicate the details of the operation, it evidently consisted in making two pairs of approximately parallel orthogonal incisions, as in the previous cases. The aperture is large, averaging 35 by 40 or 42 mm., measured on the outer surface, and 2 or 3 mm. less in either dimension measured on the interior; but the transverse (and longer) dimensions can not accurately be determined, since the narrow selvage of bone between the superior longitudinal incision and the sagittal suture is lost. The incisions projected somewhat beyond their orthogonals, in one case so much as 8 or 9 mm., and the bone is well enough preserved to show that they were V-shape in section, narrowing and shallowing to the termini, as in the preceding specimens.

There is nothing to indicate whether the operation was late antemortem or early post-mortem, no smoothing of sharp edges, no reparative growth, no indications of diseased condition of bone or periosteum, no definite trace or lesion other than that of the operation.

Cranium 4

(Plates VIII, IX)

This specimen is bleached and somewhat weathered and broken, though in good condition about the locus of the single operation. The sutures are incipiently anchylosed, indicating maturity, though the posterior molars are immature. The cranium is much lighter and thinner than the average of the collection, being fairly comparable in this respect with the Caucasian normal; as revealed in the aperture, the bone ranges from 2 to 3½ mm. in thickness.

The operation, located in the frontal bone on and to the left of the median line, cornering just above the left orbital ridge, was incomplete. It comprised two approximately orthogonal trios of approximately rectilinear incisions, each similar to those of the preceding specimens, so placed as to describe four contiguous quadrilateral buttons, of which one remains in place. The aperture, if completely opened, would average about 30 by 37 mm. The six incisions are V-shape in section, narrowing and shallowing to the termini, and project 3 to 14 mm. beyond their orthogonals; and there are a few random scratches, giving the usual testimony concerning the character of the instrument employed. The incompleteness of the opening, in conjunction with the relations of the incisions, indicate clearly the procedure of the operator. Evidently the operation was begun with only a vague notion as to the dimensions of the button to be removed, and the operator clumsily located the incisions in indefinite fashion rather than in accordance with a clearly formed plan: and as the two outer incisions approached the supra-orbital ridge they were diverted by that prominence in such manner as to give them, particularly the longitudinal cut, a curvilinear form. The appearance of the kerfs indicates that the lateral longitudinal incision through a part of its length, the anterior transverse incision for a short distance, and both the central incisions, completely penetrated the inner table and invaded the intracranial tissues, but that in general the incisions were not carried entirely through the bone, and sometimes only into the diploe, when the operator had recourse to an elevator. The marks indicate also that the elevator was inserted over the interior angle of the medio-posterior button (or quarter button) in such manner as to lift the inner edges of one or more of the other buttons, and that pressure was exerted until they were broken out, singly or together, and until the corner of the remaining button was chipped or spalled off under the strain. At this stage the operation was abandoned, the sharp edges of broken bone being left untouched: and there is no trace of reparative growth.

There is nothing to indicate certainly whether the operation was late ante-mortem or early post-mortem, further than the abandonment of an incomplete operation suggesting death in the hands of the operator, and the cuts extending through the bone and into the cerebral tissues in such manner as probably to produce fatal results; nor are there traces of antecedent lesion.

There is a depression about the center of the right half of the frontal bone, apparently the record of a blow received long before death.

Cranium 5

(Plates X, XI)

This specimen is one of the largest in the collection; it is in good condition, having been taken from a mummified body in a fair state of preservation. The sutures and teeth indicate approaching maturity. The skull is strong and symmetric, though thinner than the average

ANTERIOR ASPECT OF CRANIUM 4, FROM HUAROCHIRI

SUPERIOR ASPECT OF CRANIUM 4

ANTERIOR ASPECT OF CRANIUM 5, FROM HUAROCHIRI

SUPERIOR ASPECT OF CRANIUM 5

of the collection, ranging from 2½ to 5½ mm. about the single extensive aperture. There are three distinct interparietal bones, one 25 mm. across, the other smaller.

The operation represented by the specimen was performed on the right side of the frontal bone, extending from the median line to the coronal suture, passing about 30 mm. above the orbit. It was performed by means of a number of rectilinear incisions of the usual V-shape section and attenuated termini. While somewhat random in distribution, the outer incisions cross at large angles, describing a somewhat irregular polygon. In addition to those made about the aperture, there are others extending over to the left side of the frontal bone, indicating far-reaching exploratory and tentative cutting on the part of the operator; and a series of shallow scratches extends backward from the lateral extremity of the aperture for 25 mm. on the left parietal. Including the minor scratches, there were at least twenty different incisions, nearly all penetrating the outer table, with at least four or five penetrating the inner table, in some cases so far as evidently to penetrate also the dura mater. It would appear that, after this hacking of the skull, the operator raised the included fragment or fragments, probably in several pieces, by means of elevators, producing an aperture fully 65 mm. long by 33 mm. in maximum, and some 24 mm. in average width. There was no final smoothing of sharp edges; and naturally there is no indication of subsequent reparative process.

In this case, as in the last, there is a lack of conclusive evidence as to whether the operation was late ante-mortem or early post-mortem, though not only the abandonment of the operation and the nature of the wound produced thereby, but a decided local staining of the skull and absence of soft tissues, bringing to mind the interpretation by the Peruvian commission of the fatal wounding recorded in the cranium of Pizarro,[1] suggest that the instrumentation was ante-mortem and fatal in its results. There is no unmistakable trace of lesion other than the slashes of the rude instrument with which the operation was performed, unless it be an irregular scar or sinuous scratch, about 1 mm. broad and half as deep, skirting the right supraorbital ridge to the median line, and thence wandering upward and toward the left to a point 30 mm. above the center of the left orbit, which on the whole seems to be post-mortem.

It may be observed that both these cases show that it could not have been the design of the operator to obtain a button or rondelle, since the incisions were so placed as to divide the extracted piece into fragments.

Cranium 6

(*Plate XII*)

This fragmentary specimen is a well-preserved right parietal bone of a relatively thin cranium, measuring 3½ to 4½ mm. about the single

[1] "The Remains of Don Francisco Pizarro," American Anthropologist, vol. vii, 1894, pp. 1–25, especially p. 7.

artificial aperture. The bone is somewhat bleached and cracked, but is in sufficiently good condition to indicate clearly the modus operandi.

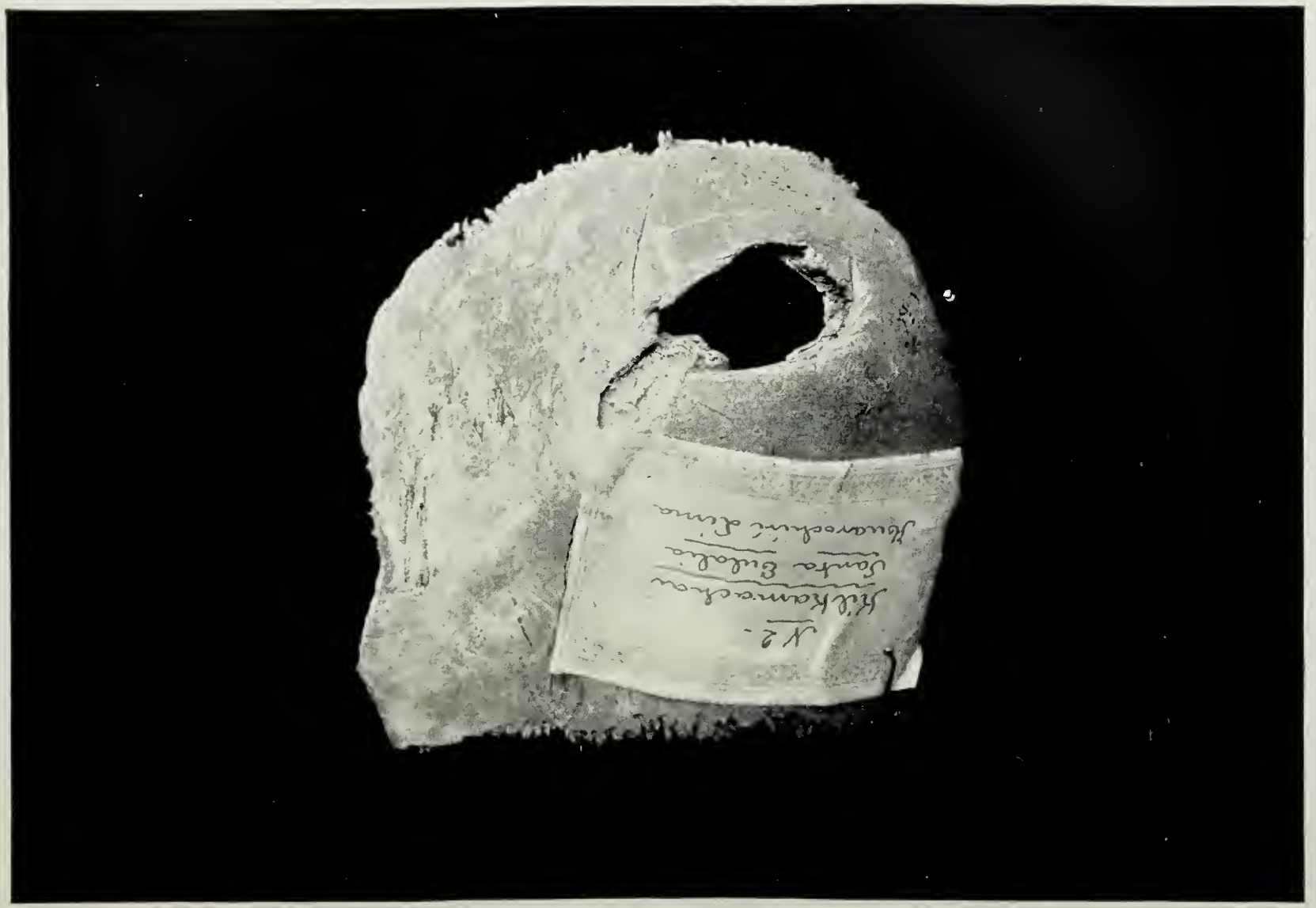
The locus of the operation is near the posterior angle of the bone, centering about 40 mm. to the right of the sagittal suture, and the same distance above the lambdoid. The aperture is elliptical, measuring about 22 by 43 mm. on the outer surface, somewhat less on the inner. Evidently it was performed chiefly by means of a single curvilinear incision, apparently followed by the use of an elevator; and the scratches leaving the upper incision show that the curvilinear character was given by gradually changing the direction of the reciprocal or sawing motion as the incision was extended from the anterior extremity inward and backward. The marks indicate, too, that the instrument was a somewhat blunt single-point blade, which ground the bony substance with rough sides as well as a jagged tip. The sharp edges of the bone were not reduced after the operation, nor is there any sign of subsequent physiologic process.

In this, as in some other cases, there is no certain means of determining whether the operation was ante-mortem or post-mortem, though it must have dated about the time of death; but in this instance there is fairly decisive evidence that the operation was located by an antecedent lesion. Seven or 8 mm. outside the posterior extremity of the aperture there is a curvilinear crack in the outer table of the skull which, though partially obliterated by exploratory scratches, can easily be traced to its passage into the lower side of the aperture, where it invades the inner table and coincides with the margin of the opening thence nearly to its anterior extremity. While it would seem barely possible that this fracture might have been produced in connection with the operation, the indications are much stronger (amounting almost to conclusive evidence) that it antedated the operation, and was part of a depressed fracture, in which the bone was broken through in undercut fashion on the lower side of the aperture, and bent inward above, where the incision was afterward placed.

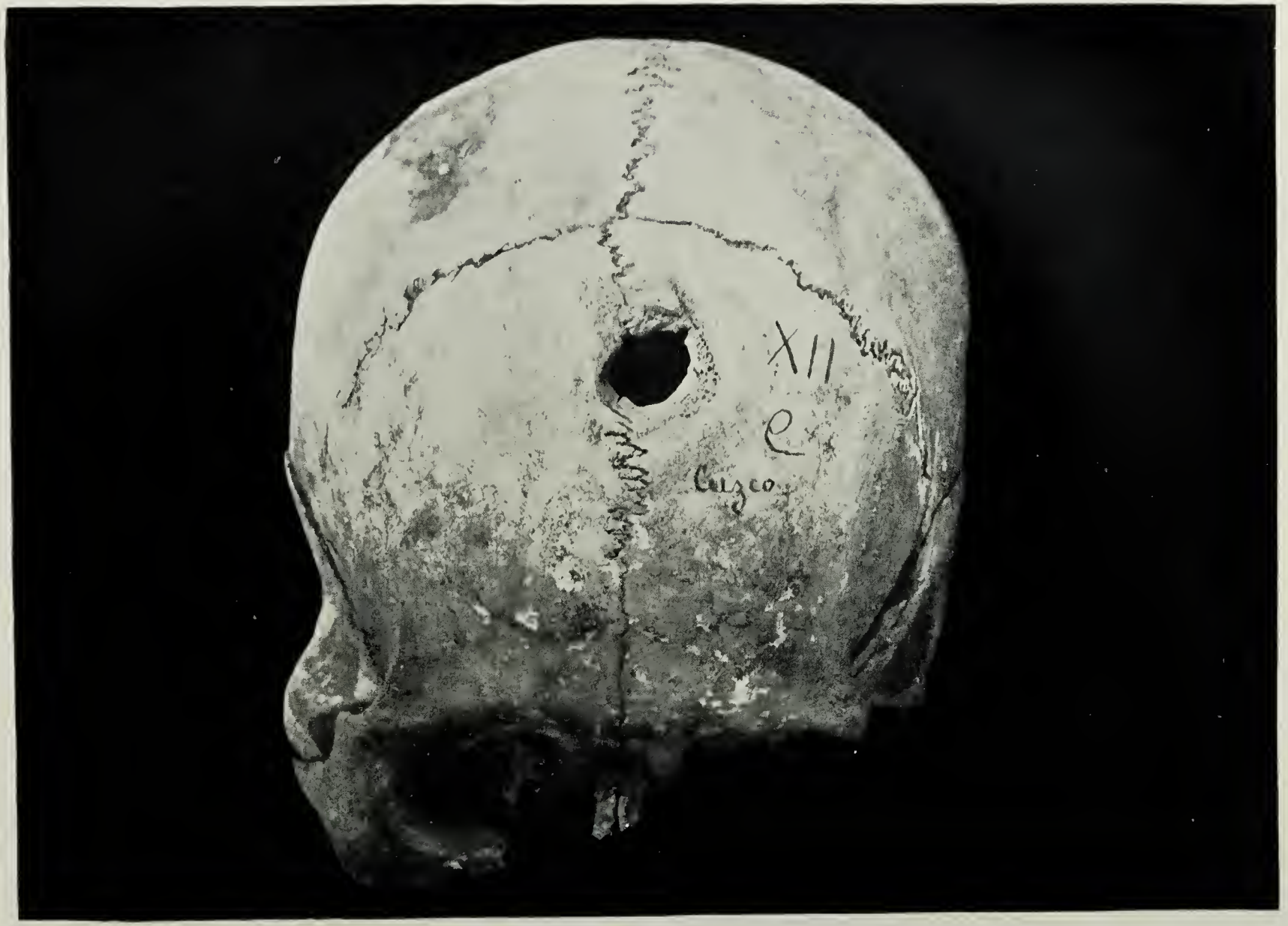
CRANIUM 7

(Plates XIII–XV)

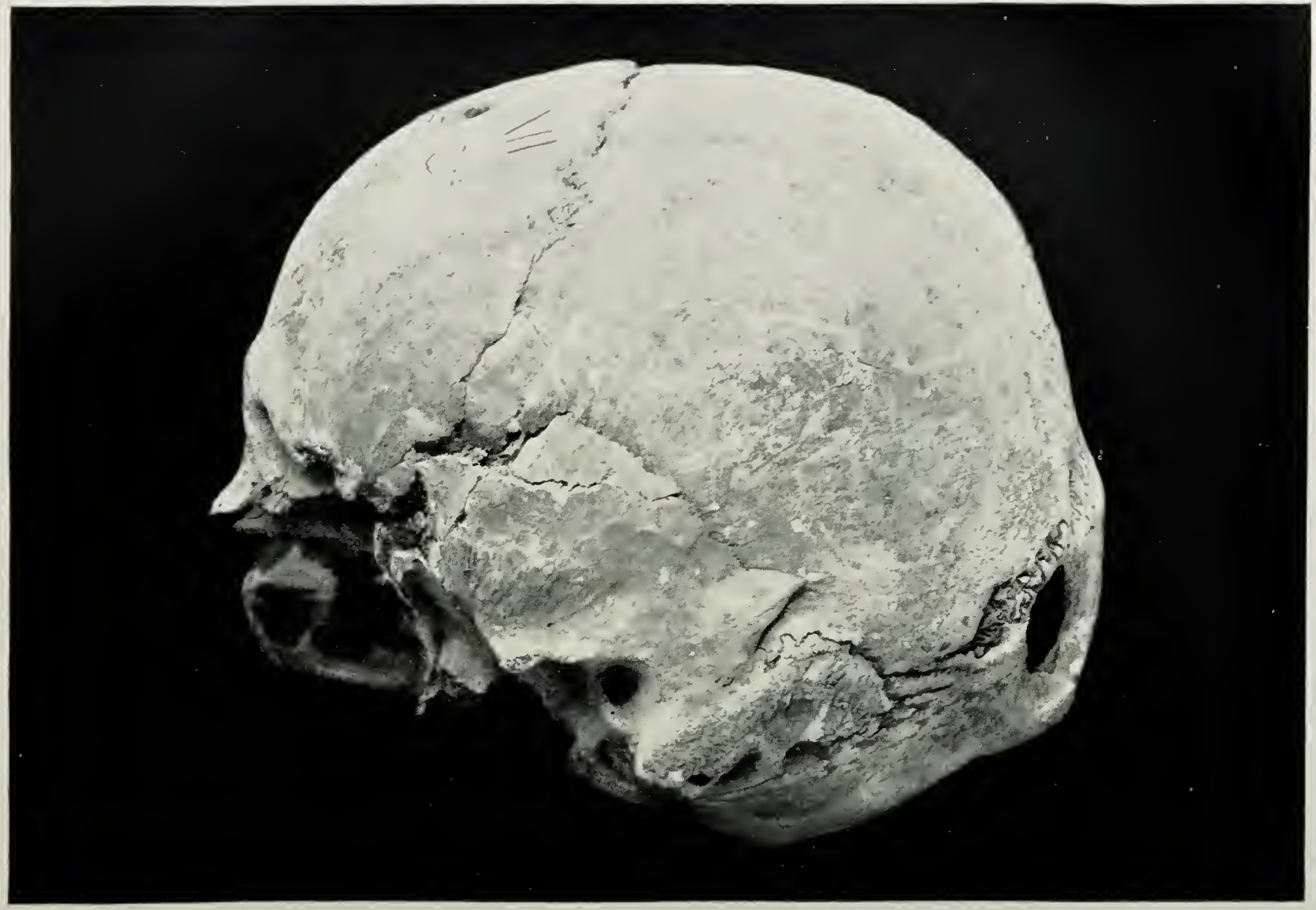
This specimen is fairly preserved, having been taken from a mummified body, though it is weathered about the lower part of the left side, and somewhat about the occiput; no tissue remains, but portions of the bone are fatty and gelatinous. The skull is quite thick and strong, with an immense occipital protuberance; it measures 6 to 8 mm. in thickness about the loci of the two operations. The temporo-parietal sutures were incipiently anchylosed, as was also the coronal, especially on the right, though the sagittal and lambdoid remain conspicuous, the condition on the whole indicating full maturity. There are two or three irregular interparietals; while the metopic suture is distinctly preserved.



RIGHT LATERO-POSTERO-SUPERIOR ASPECT (INVERTED) OF CRANIUM 6, FROM HUAROCHIRI



ANTERIOR ASPECT OF CRANIUM 7, FROM CUZCO (DOUBLE-TREPHINED)



LEFT LATERAL ASPECT OF CRANIUM 7

POSTERIOR ASPECT OF CRANIUM 7

Of the two operations displayed, the clearer as regards modus operandi is high in the frontal bone, invading the metopic suture, and centering 30 mm. below the coronal. The aperture is approximately circular, averaging some 27 mm. in diameter, measured on the outer surface, and rather less than 20 mm. measured on the inner surface. While the marks of the instrument are indistinct, the general character of the incisions is fairly indicated. The most clearly defined incision is an approximately rectilinear cut 25 mm. long, defining the left side of the aperture, curving anteriorly toward the metopic suture, which it just reaches some 20 mm. beyond the point of sharpest curvature. The other side of the aperture is defined chiefly by two fractures, one of which apparently was located by an incision some 20 mm. in length just on the right of and parallel to the metopic suture. So far as preserved, the principal incision is V-shape in section, attenuating toward one extremity but becoming indefinite toward the other; and it seems to have been carried through the outer table throughout most of its length and around the sharper part of the curve, and also nearly or quite through the inner table about the middle part of its length; then, as the walls of the aperture indicate, an elevator was inserted and the button was broken out entire or, more probably, in fragments by leverage over the firm bone outside the region of cutting. Striæ extending from the termini of the two horizontal incisions indicate slipping of the instrument, or preliminary exploratory cutting; and these, together with the features of the main incisions, bear the usual testimony as to the use of a single-point blunt instrument, apparently of stone. The extension and conformation of the cuts are best explained on the supposition that the operator occupied a rather low seat and held the head of the patient (sitting or reclining on the ground or floor facing toward the operator's right) between his knees, using his right hand for the cutting, and sometimes turning the head slightly as the work progressed. The sharp edges of bone, particularly in the outer table, were finally smoothed off, though whether intentionally by the operator or subsequently by reparative process is somewhat questionable; yet the condition of both tables and diploe indicate with practical certainty that the sufferer survived the operation for months or years. No trace of lesion antecedent to the operation appears, and the bone is so thick and the aperture so small as almost to prove that there could have been no antecedent depressed fracture or related injury.

The locus of the other and earlier operation is the upper left portion of the occipital, just invading the lambdoid suture. The aperture is elliptical, measuring 18 by 23 mm. between the narrowest portions of the walls. At this point the skull is somewhat eroded by weathering, and the margins, especially toward the lambdoid, are slightly crumbled; yet the state of preservation suffices to indicate long-continued reparative process whereby the bony margins were smoothed and rounded, the diploe completely obliterated, and all traces of instrumentation

eliminated. In a general way the operation would seem to have been similar to the later one in the anterior part of the head, though doubtless performed several years earlier. As in the later operation, traces of antecedent lesion are conspicuously absent, and the attendant features are hardly consistent with the supposition of considerable traumatic injury.

The usual long-healed grooves over the temples appear in the specimen, two of exceptional length on the right and two or three on the left; there are no other scars or abnormal features, save the vestigial preservation of the metopic suture.

Cranium 8

(Plate XVI)

Although fragmentary only, this specimen is well preserved, and represents a large and strong cranium, the bones averaging 5 mm. or more in thickness. The sagittal suture is almost completely anchylosed, and the lambdoid greatly obscured, indicating fully mature age. The specimen displays a well-defined artificial aperture in addition to a smaller opening, possibly artificial but more probably a pathologically persistent parietal foramen.

The undoubted operation was located on the top of the head, i. e., near the antero-superior angle of the right parietal, centering 28 mm. from the sagittal suture and 35 mm. from the coronal. The aperture is approximately circular, averaging 30 mm. measured on the outer surface and 27 mm. on the inner. The traces of primary instrumentation are indistinct; yet they appear to indicate careful manipulation of a blunt single-point cutting and grinding tool, held vertically on one side and obliquely on the other and worked with a short reciprocal or sawing motion in curvilinear fashion, in such manner as to define the circular aperture. The conformation of the cutting suggests an attitude of operator and position similar to that suggested by cranium 7, save that the patient faced toward the operator's left; the head was apparently rotated considerably as the cutting progressed, while the position of the tool, as held in the right hand, was somewhat oblique, undercutting slightly on the side of the aperture toward the operator's left, and overcutting considerably on the other side. It would seem that the random scratches due to slipping of the tool, particularly on the posterior and inferior sides of the opening, were subsequently ground or rasped away by rubbing with a rough tool which left fine but irregular scratches in the outer table. A few aberrant cuts extending some distance from the aperture remain; two of these, parallel to the sagittal suture, extend forward from the aperture, one for 15 mm. and the other for 22 mm. to the coronal suture, as shown in the reproduction. Despite the persistence of these marks, the character of the margins of both inner and outer tables indicates that the patient survived the operation, and that slow reparative changes, not however extending to material bony growth, supervened.

SUPERIOR ASPECT (INVERTED) OF CRANIUM 8, FROM HUAROCHIRI

ANTERIOR ASPECT OF CRANIUM 9, FROM HUAROCHIRI

LEFT LATERAL ASPECT OF CRANIUM 9

There is no certain indication of lesion antecedent to the operation, though a fracture, defining the anterior edge of the right parietal in the broken cranium, passes the sagittal suture and extends into the aperture; it is, however, probable that this fracture was long post-mortem and produced on collecting the specimen.

Cranium 9

(Plates XVII, XVIII)

The principal bones of this specimen are fairly preserved, though somewhat bleached. The skull is rather small and thinner than the mean of the collection, though the processes and attachments are strong; about the single artificial aperture it averages 3 mm. in thickness. The sagittal suture is nearly obliterated in the middle third of its length, though the other sutures are distinct, the condition on the whole indicating early middle age.

The operation displayed by the specimen was located in the middle of the left half of the frontal bone, centering about 45 mm. above the orbit; it is elliptical, with one flattened side, measuring about 16 by 25 mm. on the inner surface, or 19 by 33 mm. on the outer surface of the skull. The margins are somewhat weathered, rendering the testimony of the specimen concerning the operation and its consequences somewhat doubtful. On the whole, the form of the aperture and the features of the margin indicate that it was produced by a clumsy single-point instrument, such as a stone spearhead, rather deftly operated in such manner as to produce a curved incision describing nearly a semicircle, with the extremities more sharply curved and joined by a straight cut; the instrument being held nearly vertical while forming the sides of the contemplated aperture, but slanted toward the ends, either clumsily or to facilitate the insertion of an elevator. Apparently the edges of the aperture were afterward smoothed somewhat; yet the condition of the bone, including the obliteration of the diploe by local replacement, indicates considerable reparative process, extending to the growth of bony spicules, now largely removed by weathering and erosion. It is unquestionable that the operation was ante-mortem, and that the sufferer survived, probably for years.

While there is no clear indication of antecedent lesion, there is a faint line parallel with the superior side of the aperture and 3 or 4 mm. distant (which does not appear in the reproduction), possibly marking the limit of a small depressed fracture.

Cranium 10

(Plates XIX, XX)

This is a well-preserved skull, considerably stained with ocher or cave earth. It is small but strong, with the usual splendidly developed ligament attachments, and, though some 5 mm. thick, has been preserved in such manner as to be exceptionally light. Some of the sutures are

anchylosed and partly obliterated and others distinct, while the teeth are fairly developed, except that one posterior molar is lacking and the other imperfect, the features collectively indicating middle age.

The operation displayed by this specimen is in the posterior angle of the right parietal, extending to both sagittal and lambdoid sutures. The aperture is rudely circular and 28 or 29 mm. in mean diameter. Although the bone is in excellent preservation, it is impossible to determine the manner in which the operation was performed, since all definite traces of instrumentation have been obliterated by reparative process, including the complete replacement of the diploe and the development of strong spicules of new bone pushing into the aperture. The most conspicuous of these spicules is that clearly shown in both reproductions at the lower side of the opening. The sharp angle immediately above also represents well-developed bony growth. While the record of the operation is thus obscure, it is nevertheless fairly if not finally evident that the operator proceeded in a manner unlike that represented in most or all of the preceding specimens. The conspicuous feature of the artificial work lies in the fact that the bone attenuates uniformly toward the edges of the aperture as if removed by scraping or grinding, perhaps with an edge or rasp-like side of considerable length. (This is well shown in plate XX.) There are, however, a few exploratory scratches, notably one extending forward from the upper margin of the grinding, 30 mm. from and nearly parallel with the sagittal suture.

No antecedent lesion can be detected, but it is certain that the patient survived the operation long, probably many years. The cranium displays three great grooves over either temple arranged in symmetric pairs.

CRANIUM 11

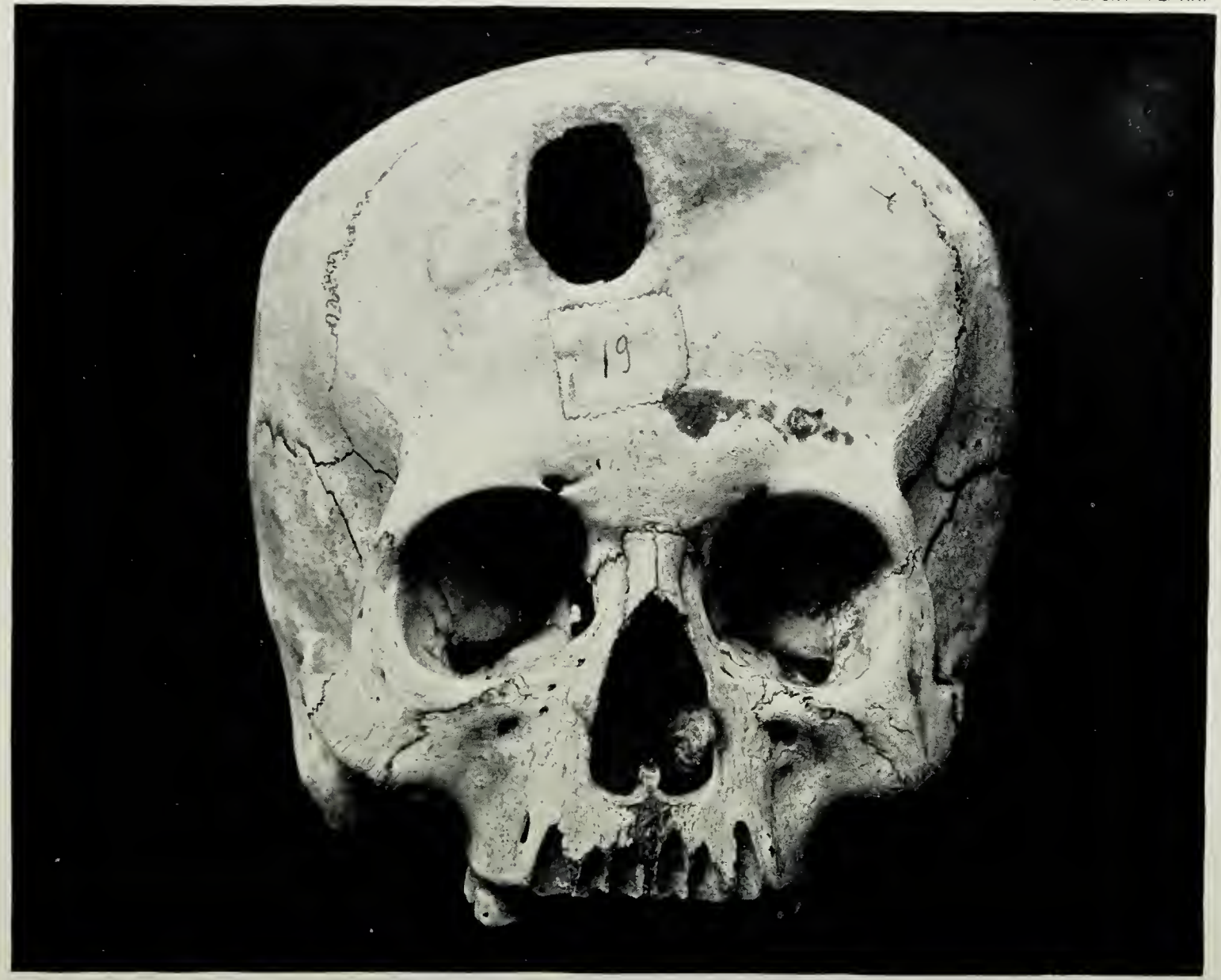
(Plates XXI, XXII)

Although somewhat bleached and weathered, this cranium is in excellent condition. The occiput is singularly flattened, particularly on the left, as shown imperfectly in the right aspect represented on plate XXII. There is some flattening also of the face, with an apparently abnormal shortening of the mandible. Two or three small interparietals occur. The bones are rather thin, ranging from $2\frac{1}{2}$ to $4\frac{1}{2}$ mm. The teeth are exceptionally mature for the collection, though the sutures remain distinct.

The operation for which the specimen is notable was performed near the center of the frontal bone, a little to the right of the median line, and extending from 37 mm. above the orbit to within 22 mm. of the coronal suture. The aperture is an elongated ellipse, 21 or 22 mm. in maximum width by 40 in length, measured on the feather edge of the inner table. In this case, too, all definite traces of instrumentation are lost, partly by weathering though chiefly by reparative process. The margins of both tables are rounded, the diploe is completely obliterated,

POSTERIOR ASPECT OF CRANIUM 10, FROM CUZCO

RIGHT LATERAL ASPECT OF CRANIUM 10



ANTERIOR ASPECT OF CRANIUM 11, FROM PACHACAMAC

RIGHT LATERAL ASPECT OF CRANIUM 11

and there are a few small spicules of new bone projecting into the aperture, notably a sharp point at the anterior extremity (shown clearly in plate XXI). So far as can be judged, the modus operandi was similar to that represented in cranium 9, with subsequent grinding or rasping of the outer table to remove the raw edges; yet it is quite possible that the aperture was made wholly by scraping.

No trace of lesion antecedent to the operation remains. It is clear that the sufferer lived for some time, certainly months and probably years, after the treatment. The usual vertical cut in the bone appears above the right temple.

CRANIUM 12

(Plates XXIII, XXIV)

Although nearly white, as if bleached, this cranium was taken from a fairly well mummified body, and fragments of ligaments and other tissues remain, while the bone is fatty. The specimen is small, rather light and thin, somewhat delicate in outline, with less conspicuously strong attachments than most of the collection; it is one of two crania suspected to be feminine. The teeth are nearly mature and the sutures somewhat obscured; there are over half a dozen little interparietals.

The rather complex operations were located about the center of the superior side of the occipital. The principal aperture is rudely circular, interrupted by an irregular salient, and averages perhaps 26 mm. in diameter; the next in size is an irregular oblong about 8 by 12 mm., and the smallest is an approximate circle some 6 mm. in diameter. The marks of instrumentation are rather indefinite, and are practically absent about most of the margin of the largest aperture. So far as can be judged, the initial operation was begun by a curvilinear incision extending from near the center of the occiput upward and forward nearly to the lambdoid suture, where it was curved sharply and afterward connected with another curvilinear incision defining the mediosuperior side of the largest opening. It would seem probable that the principal button was then removed by the aid of an elevator, leaving a ragged margin on the median side, and that the edges of the outer table were then scraped smooth and neatly beveled. Afterward considerable physiologic action apparently supervened, whereby the tool marks were obliterated, while the diploe was solidified and the cut surface brought into the condition of normal bony surface, the period of reparation being probably months, possibly years. Then ensued the later operation, beginning with a transverse rectilinear incision some 40 mm. long extending from near the center of the occiput to the inferior margin of the antecedent aperture and passing into extensive scraping of the bone, thence upward nearly to the suture and rightward to the large opening. Further than this, the modus operandi seems still more doubtful, though minute scratches, as well as the general conformation, would indicate that the oblong aperture was produced by scraping.

There is nothing clearly to indicate how the smallest aperture was produced, though it has every appearance of artificial origin, and there are decisive indications, in the preservation of the tool marks and the retention of normal character by the diploe, that both of the medial openings are much more recent than the large one; indeed, it is doubtful whether the sufferer survived the later operation, and the conformation of the smallest aperture indicates pretty clearly that the underlying tissues were invaded so seriously as to produce death. In general, the operations display some evidence of both rectilinear and curvilinear incisions, such as those characteristic of the earlier members of the series, with definite indications of subsequent scraping or grinding.

There is no definite indication of antecedent lesion; although the general appearance of the bone and the distribution of the openings vaguely suggest a diseased, possibly leprous or syphilitic, condition, the suggestion vanishes when the firm, sound bone is examined closely. Near the antero-inferior angle of the right parietal there is a darkened and evidently abnormal tract, more conspicuous in plate XXIV than in the specimen, perhaps the trace of local ostitis induced by a blow; there is also a dent, with some crushing of the bone, 35 mm. above the left orbit, and one of the customary vertical grooves appears over the right temple.

CRANIUM 13

(Plate XXV)

This specimen is perhaps the least satisfactory of the series, chiefly because of the weathering and erosion to which it has been subjected. It is small but thick, averaging probably 6 or 7 mm., with the usual prominent occiput and attachments. The teeth are fairly developed and anchylosis is well advanced, indicating maturity; as usual, there are several small interparietals.

The more significant of the two operations displayed by the specimen was performed in the top of the head, involving the sagittal suture, and apparently extending also into or across the coronal, though this is rendered somewhat doubtful by weathering and a recent fracture. This aperture is oblong, 12 mm. wide and (probably) 20 mm. or more long. No trace of instrumentation remains; the margins are thoroughly rounded and the diploe is completely obliterated, giving an air of antiquity to the opening; undoubtedly the sufferer survived the operation for many years, despite the infraction of a modern rule against trephining over sutures.

The locus of the second operation was the upper part of the left parietal, centering about 40 mm. from the earlier one, and about the same distance from the sagittal and coronal sutures. The aperture is oval, about 17 mm. in breadth by 22 in length. The surrounding bone is somewhat eroded, yet enough of the original surface remains to indicate clearly a reparative rounding by physiologic process, similar

POSTERIOR ASPECT OF CRANIUM 12, FROM CUZCO (DOUBLE-TREPHINED)

RIGHT LATERAL ASPECT OF CRANIUM 12

SUPERIOR ASPECT OF CRANIUM 13, FROM CUZCO (DOUBLE-TREPHINED)

to, though less advaneed than in eonneetion with the other aperture in the same cranium, and quite similar in eharaeter and advaucement to that displayed by the earlier operation in cranium 7. Both tables display short and small knobs or spicules of reparative growth, and fully half of the margin of the inner table shows the peeuliar conformation and coloration characteristic of sueh growth, as may clearly be seen in the reproduetion. The diploe is obliterated on the anterior side of the aperture; on the posterior side it was partly absorbed (though the spongy texture was modified through replacement as in most of the examples), leaving a groove 3 mm. wide and 2 to 3 mm. deep between the tables. So extensive are the subsequent physiologic modifieations that all trace of instrumentation has been obliterated. Evidently the sufferer survived this operation, also, for a eonsiderable period, probably a number of years.

In neither case is there the slightest traee of antecedent lesion. It may be noted that the outer table about the apertures, particularly the later, is somewhat rough as to surface and vesieular in texture, probably by reason of physiologic and post-mortem proeesses initiated by the operation, but possibly beeause of earies.

For purposes of eomparison and to eomplete, so far as practieable, the illustration of trephined crania from Peru, the eight speeimens illustrated on plates XXVI and XXVII are introdueed. The reproductions are half-tone engravings from small photographs obtained by Dr Muñiz. The specimens are preserved in the museum at Cuzco.

Figures *a* and *b*, plate XXVI, represent crania penetrated by large and irregular apertures, showing no definite traces of instrumentation. In figure *a* the margins are jagged, suggesting the enlargement of an original aperture by the use of a vigorously applied elevator fulcrumed on the opposite margin; there is no traee of subsequent growth, and consequently nothing to indicate the purpose of the operation, or whether it was late ante-mortem or post-mortem. Similarly in figure *b*, the irregular form and absence of ineisions suggest extensive use of the elevator; while the rounded margin, particularly on the anterior side of the aperture, indieates subsequent reparative proeess, and thus shows that the operation was ante-mortem. In figures *c* and *d* (plate XXVI), in like manner, all trace of instrumentation has been obliterated by subsequent growth, which in both eases (partieularly the latter) is extensive and charaeteristie. The operation represented in figure *c* involved the eoronal suture. In figure *d*, in less measure in figure *c*, and to a still less extent in figure *b*, there are suggestions of malformation or of general pathologie eondition resulting in neerosis, followed by the reparative proeess indicated; but the suggestion does not demand serious eonsideration, partly because of its improbability in view of the eharaeteristies displayed by the Muñiz colleetion, partly because the question could be set at rest only by examination of the crania themselves.

The specimen illustrated in figure *a*, plate XXVII, displays two apertures, both of somewhat doubtful character. One is an elongated slot, the outline and sharp edges of which suggest the use of a metal instrument; but the method in which the operation was performed can not be determined from engraving or photograph. The cranium represented in figure *b* exemplifies a mode of operation distinct from any of those indicated by the Muñiz collection. In one case there are three rather small perforations placed in the form of a triangle. The perforations suggest the use of a drilling or boring instrument, perhaps similar to the brima used by the Kabyle, and their arrangement suggests that the drilling was followed by the use of a strong elevator and the breaking out of the fragment described by the perforations, also after the manner of the Kabyle. The large aperture made above the right orbit in the same specimen would appear to have been produced in this way. In this manner, too, the huge aperture in the specimen shown in figure *a*, plate XXVI, might have been produced. The reproduction suggests the employment of rude metal instruments, although the operation is of no higher order than those revealed in the Muñiz collection, and although the drilling and elevating might easily have been effected by stone perforators and elevators of bone or wood. The operations represented in figure *b* and the elongated opening shown in figure *a* (plate XXVII) reveal no indications of subsequent growth, and may accordingly have been late ante-mortem or post-mortem.

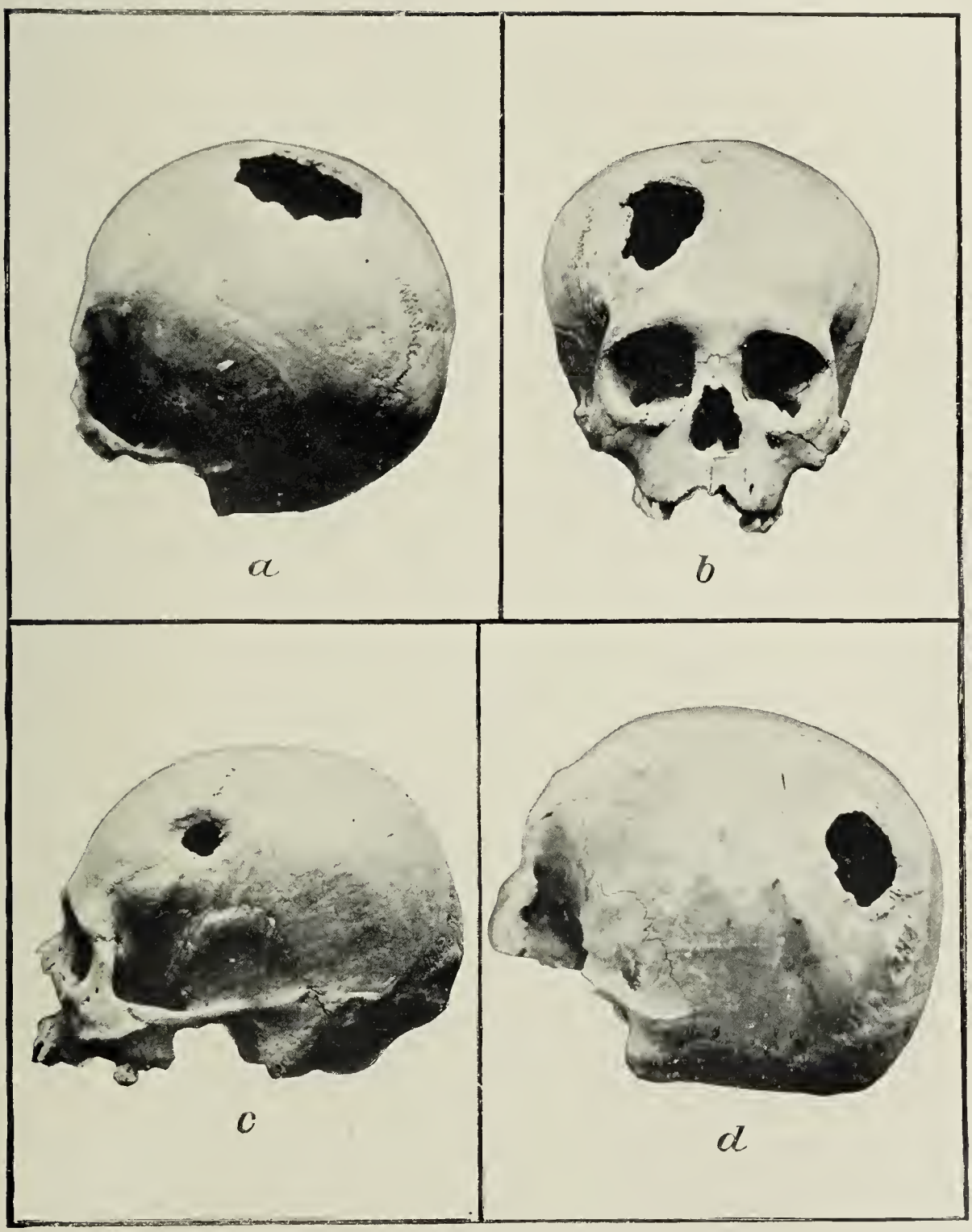
The figures *c* and *d*, in plate XXVII, represent two approximately circular operations, comparable with several of those revealed in the Muñiz series. Viewed in the light of these examples, it would appear that both were performed by means of somewhat irregular curved incisions, followed by the use of the elevator, and that the margins were subsequently beveled by rasping or scraping; it would appear also that both individuals long survived the operation, as indicated by reparative growth and rounding of surface, and the partial obliteration of the diploe.

CRANIUM 14

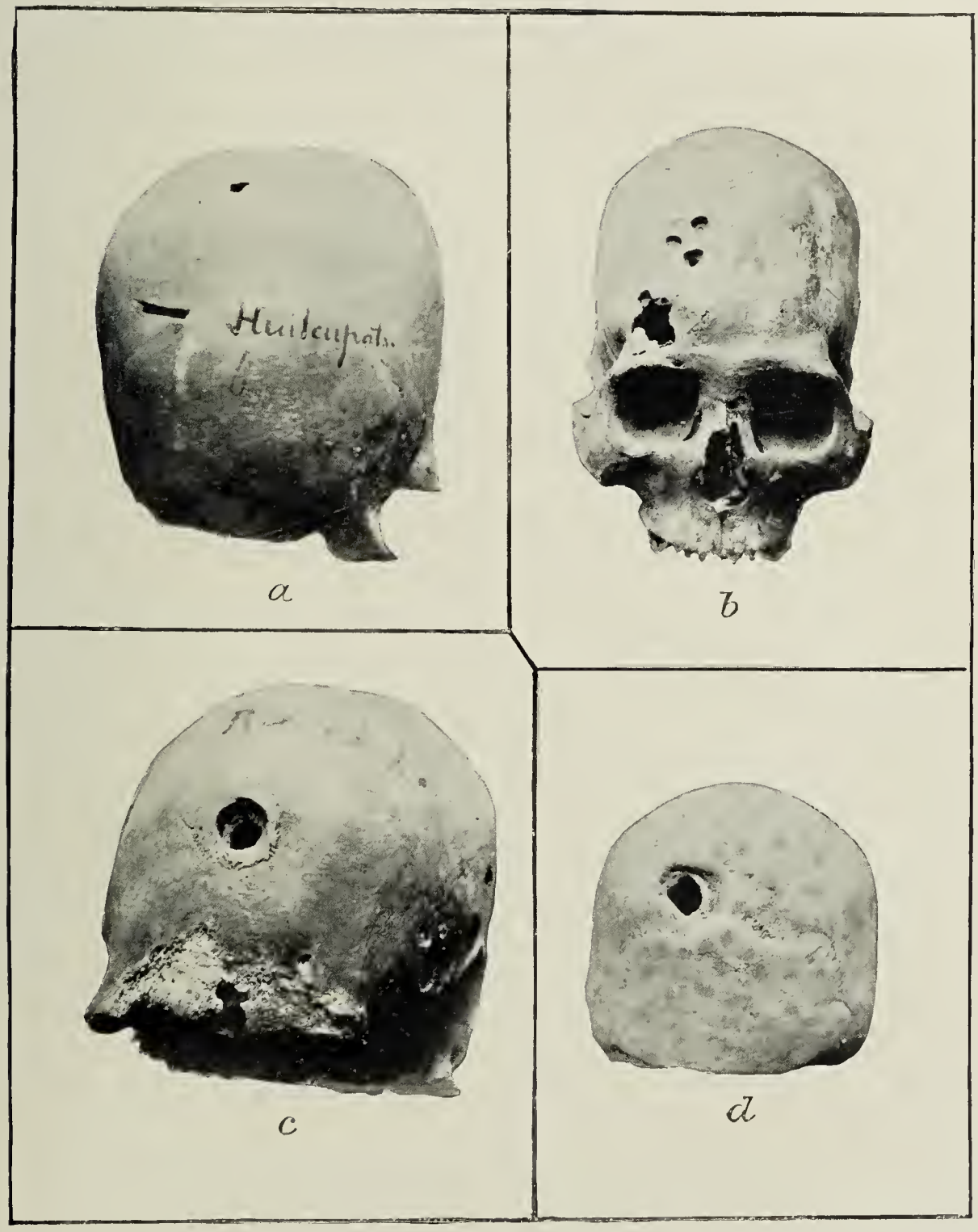
(*Plates XXVIII, XXIX*)

This specimen is a mummified head, with most of the scalp and facial integument and some of the hair remaining. The mature development of the teeth and the condition of the small portion of the sutures visible indicate maturity; the hair is not gray. The tendons are well developed; the skull is thinner than the average for the collection, measuring about 3 mm. at the point of operation.

The single incomplete operation displayed by the specimen is remarkably instructive. It was located by a depressed fracture in the left side of the frontal bone, centering 45 mm. above the orbit, and extending just to the coronal suture; in this fracture a section of both tables 15 by 20 mm. was forced inward, hinging at the left, but completely



FOUR CRANIA PRESERVED IN MUSEUM AT CUZCO



FOUR CRANIA PRESERVED IN THE MUSEUM AT CUZCO

severed on the lower side, around the median end, and part of the way around the upper margin; this tongue of bone is itself indented and warped, evidently by the force of the blow producing the fracture; and two fissures partially crossing its base nearly separate it from the uninjured bone. The rupturing of the inner table was quite as complete as that of the outer; the inner table was split and torn apart beneath the depressed tongue, and a sliver 15 mm. long and 10 mm. wide remains attached at the lower anterior side of the wound. Apparently a narrow zone of the outer table has disappeared from this portion of the wound, since the depressed tongue is 1 or 2 mm. narrower than the aperture; and the antero-superior extremity of the tongue has also disappeared, leaving a clear aperture of about 5 by 10 mm. In general the wound is more extensive on the inner surface of the cranium than on the outer, for, as is usual in case of depressed fracture, the margins are undercut, the tables separating somewhat on the diploe. The features of this wound are slightly masked by the marks produced in the unfinished operation.

The indubitable features of the operation are three principal incisions, with a number of minor scratches. The most prominent incision is nearly horizontal, traversing the upper part of the wound; it is 30 mm. in length and penetrates both tables of the bone for a length of 10 mm. immediately above the wound. Its anterior extremity divides into two strong and several feeble scratches, each evidently made by a single moderately sharp point; the deeper portions are V-shape in section, and the wall of the incision above the wound shows parallel striation, as if ground by a rough surface; in short, the incision is precisely such as would be produced by a rather sharp stone knife or spearhead, worked reciprocally with considerable pressure, and the associated scratches are such as would almost inevitably be produced by the slipping of such an instrument in the hands of a clumsy operator at the beginning of the operation. The second incision starts from the anterior extremity of the first, at an angle of about 60 degrees, and skirts the lower margin of the fracture for half its length, i. e., for about 19 mm. It is a minature homologue of the incisions displayed in cranium 1 and other specimens, V-shape in section, deepest and broadest toward the middle, narrowing and shallowing to mere scratches at the extremities; in this case, too, there are a few scratches, evidently due to the slipping of the instrument. For a length of 5 or 6 mm. it enters the diploe; it does not penetrate the inner table. The third incision crosses the first near its posterior extremity, at an angle of about 60 degrees, the three being so placed as to describe an equilateral triangle coinciding with the anterior third of the fracture. This incision is 11 mm. in length, projecting 6 mm. beyond the first incision (which itself projects 3 or 4 mm. beyond this, though not clearly shown to do so in the reproduction). It penetrates both tables of the skull just above the wound, and terminates abruptly at the fracture, the relations being

such as to prove conclusively that the fracture preceded the incision. In this case, too, there are irregular scratches about the extremity of the incision, showing slipping of the tool. The terminus of a fourth incision or series of incisions appears near the anterior extremity of the wound, approaching the central part of the second incision. These deep scratches were apparently made on a hinged fragment of the bone connecting this part of the skull with the principal depressed tongue; and it is evident, first, that they were not made until after the fracture, and, second, that a fragment of bone has disappeared since they were made. In addition to these definite incisions, there is a shallow cut or scratch 15 mm. long, nearly parallel with the second incision, extending from the anterior extremity of the wound toward the median line; it is indistinctly shown in plate XXIX.

It is noteworthy that the bone was stained and the periosteum modified over a tract considerably larger than that of the fracture (though this is not clearly indicated in the reproduction). On the lower side of the wound this tract is not clearly defined, though its margin seems to be close to that of the fracture; but on the upper and posterior sides it forms a zone 10 to 15 mm. wide, semicircumscribing the wound. This feature is especially significant in connection with the local discoloration and modification of several other crania, notably 1, 2, and 5. It would appear to represent extension of the injury to the soft tissue, perhaps resulting in periostosteitis, or death and exceptionally rapid post-mortem decomposition in advance of mummification.

The sequence of events and movements in the history of the case is indicated by this specimen with considerable clearness and certainty. It is evident that the first event was the production of the wound by impact of a hard object (perhaps a sling stone or club spike). It seems probable that several hours then passed without treatment, during which local inflammation developed and extended to the periosteum. Then the operation was commenced, apparently by opening the scalp and laying bare the bone (since otherwise the subsequent removal of bony splinters could hardly have taken place). Then it would appear that a short incision (the fourth of the foregoing description) was made, whereby one or two fragments of bone were liberated and removed from the anterior and lower margins of the wound. Then the principal incision skirting the upper side of the wound was made, and another splinter partly liberated; and, to dissever this splinter, the short incision above the depressed tongue was then produced, when the fragment was broken out by means of an elevator, leaving a small irregular projection of the inner table just beneath the intersection of the two incisions. It would appear that the anterior incision was then started for the purpose of removing the rough edges of the bone and giving access to the conspicuous sliver of the inner table at the lower side of the fragment. This incision was soon abandoned, and the operation discontinued. There is nothing to indicate whether the scalp was

ANTERIOR ASPECT OF CRANIUM 14, FROM HUAROCHIRI

LEFT LATERO-ANTERIOR ASPECT OF CRANIUM 14

restored, and everything to indicate that death supervened about this stage.

It may be observed that this specimen displays decided facial distortion, the mouth, nose, and tongue being strongly drawn toward the right. Whether this distortion was in any way connected with the wound or the operation is an interesting question, but one that need not be pursued for the present, since it would seem impossible to arrive at certain or useful results.

Cranium 15

(Plates XXX–XXXII)

The specimen is in excellent condition, the bones being perfectly preserved, and a considerable part of the scalp and other tissues remaining. The skull is strong, with the usual rugose attachments. Its thickness varies from 3½ to 5 mm. about the single artificial aperture. The teeth are only fairly mature and anchylosis of the sutures is but moderately advanced, indicating that the individual died in his prime.

The incomplete operation, which reveals the methods of the operator with gratifying clearness, was located by a fracture near the posterior angle of the left parietal, extending to within 15 mm. of the sagittal and lambdoid sutures. The initial wound depressed a tract of bone about 47 mm. long and rather over 20 mm. wide, measured on the outer table. Toward the sagittal suture and along the lower margin the inner table is undercut 2 to 5 mm. The indications are that the bone was completely severed more than halfway around the oblong aperture, remaining hinged at the upper and anterior margins. In addition the outer table was cracked concentrically with the central part of the wound, parallel with the upper margin and some 10 mm. from it, as shown clearly in plate XXXII. The instrumentation comprised three definite incisions. The most conspicuous of these is an approximately rectilinear cut 37 mm. long, skirting the upper part of the fracture and penetrating the inner table for a distance of 12 mm. The projecting extremities are of the usual V-shape section and termination, and longitudinal striæ appear in the remaining wall of the incision, showing that the instrument was of the kind indicated in other operations. The second incision in extent describes the upper and posterior side of the aperture, originating near the extremity of the first incision. It is 27 mm. long, extending somewhat farther in a narrow scratch, and penetrating the inner table for 5 or 6 mm. near its anterior termination. The third incision describes a part of the anterior margin of the aperture, crossing the extremity of the principal incision. It is about 20 mm. long, but extended farther on the tongue of bone subsequently removed. A few shallow cuts are placed obliquely to this incision, originating at the intersection of this with the first incision and extending directly downward. These marks appear to represent a preliminary or exploratory cutting, which was abandoned when the deeper

and approximately parallel incision was outlined. In addition there are several shallow notches in the lower margin of the aperture near the anterior extremity, evidently made by striking the instrument against the outer table while sawing across the base of the depressed tongue, either in making the third incision or (more probably) in making a nearly parallel incision traversing the tongue in a somewhat more nearly horizontal direction. All of the incisions and scratches were apparently made by the same tool.

The sequence represented by the operation is indicated with considerable clearness. Initially there was a large depressed fracture with some adjacent cracking of the bone, the principal depressed tract being in the form of a tongue hinged at the anterior and upper sides, but completely severed more than halfway around. Three or more incisions were made in such manner as to divide the hinge, and in making a part of them the tool was reciprocated on the depressed bone in such manner as to leave its marks on the free margin. When the incisions were fairly advanced, an elevator was used and the depressed tongue was forced out, leaving projecting edges of the inner table on the upper margin, and this operation was performed with such vigor that the anterior portion of the hinge passed beyond the nearly vertical incision and invaded the uninjured bone, breaking through both tables and leaving the inner projecting beyond the outer. At this point the operation was discontinued, presumptively by reason of the death of the victim; the rough edges were not smoothed, and there is not the slightest trace of subsequent growth—indeed, the invasion of the cerebral tissues by the tip of the clumsily applied instrument would have been almost necessarily fatal. In this specimen there is no indication of local inflammation.

Taken together, crania 14 and 15 appear to represent somewhat different stages in precisely parallel operations. In cranium 14 the treatment was abandoned after the removal of a few fragments and splinters of bone, but before the removal of the principal tongue, while in cranium 15 it was abandoned immediately after removing the tongue or button.

Cranium 15 displays the vertical grooves over the temples, one on either side, with a few smaller marks. In addition there is a prominent scar of a practically healed wound a little to the left of the center of the upper margin of the frontal bone. The wound was evidently produced by a blow from a rather blunt edge, transverse to the median line, directed downward and forward so as to glance forward; the bone is indented and bruised, forming a transverse trough (15 mm. below the coronal suture) 5 or 6 mm. broad and 17 mm. long; below, the bone bulges slightly, and the lower side of the ridge is partly defined by a curved fracture of the outer table 18 mm. long. The edges of the fracture are knit, and there are other indications that the wound was practically recovered before death.

SUPERIOR ASPECT OF CRANIUM 15, FROM HUAROCHIRI

LEFT LATERAL ASPECT OF CRANIUM 15

LEFT LATERO-POSTERO-SUPERIOR ASPECT OF CRANIUM 15

Cranium 16

(Plates XXXIII, XXXIV)

This is a mummified head, in excellent condition for examination, and of special interest in that it reveals in part the incisions through the scalp made in connection with the principal operation. The skull is one of the largest of the series, with the customary rugose attachments and stout tendons. The teeth are fairly mature (the left posterior molar is lacking), indicating early maturity. In addition to the lesions connected with the operation, there is a deep scratch on the left side of the frontal bone, extending from 32 to 57 mm. above the orbit, and an extensive scar, some 30 mm. wide by 50 high, on the right side of the same bone, extending from the coronal suture halfway to the orbit, together with a few minor scratches; all of these marks apparently recording recovered wounds.

The complex and elaborate operation was located by an extensive wound, chiefly a linear fracture, extending from the median line of the occipital through the lower angle of the right parietal to the temporoparietal suture, along this suture for 20 mm., thence obliquely downward through the temporal bone to a point just within the zygoma, and thence upward and forward entirely across the temporal bone and half way to the margin of the left orbit; the fracture being 155 mm. in length measured directly on the surface of the skull, and about 200 mm. measured along its meandering course. The incision in the scalp began in the center of the back-head, and was carried well down over the occipital to a point apparently somewhat below the extremity of the fracture, and thence along the fracture to a point on the temporal bone near the posterior margin. The tissues were then apparently pushed aside and crumpled into irregular masses, that on the right of the incision being particularly thick. Work was then begun on the bone, apparently in random fashion; it would seem probable that the first incisions were the three nearly vertical cuts in the occipital. The deepest of these is about 37 mm. in length, and is carried into the diploe without penetrating the inner table. It is oblique V-shape in cross-section, with the usual attenuated extremities, the lower revealing a number of scratches. Parallel with it is a shallow incision of similar character, 22 mm. long and perhaps 2 mm. deep, not penetrating the outer table. Nearly parallel with these is a similar incision 35 mm. long and 3 mm. deep, just penetrating the outer table in its center. The upper extremity curves rather sharply to the left (though this does not clearly appear in plate XXXIV), while the lower extremity divides into deep scratches of the usual character, also veering toward the left. There is no indication that these deflections toward the extremities of the incision were intentional, and everything to indicate that they represented a series of slips of the tool occasioned by inequalities in the surface of the bone. Evidently these incisions were exploratory, and

were abandoned; since the last described just intersects the extremity of the fracture, which it might have revealed to the operator, it seems probable that the line of exploration was then turned toward the right along the fracture. Thirty-five mm. from the last incision there is an irregularly circular aperture, averaging 9 or 10 mm. in diameter, produced by scraping. This process extended over an area 25 or 30 mm. across, over most of which the outer table and diploe are removed and the inner table reduced to paper-like thinness. Thence a series of scratches and striæ, as if produced by scraping with a rather blunt tip or grinding with an irregularly rough surface, follow the fracture to and a little way across the lambdoid suture. At the intersection of the fracture with this suture the bone is gonged and scraped to a depth of 4 or 5 mm., or through the outer table and diploe. Thence several narrow scratches pass horizontally across the lower portion of the parietal, terminating about the temporo-parietal suture, beyond which the operation seems not to have been carried (these scratches are but indistinctly shown in the reproduction, plate XXXIII).

The sequence of events and movements in the case may be determined from the specimen with considerable certainty. The initial incident was apparently a blow or shock producing the linear fracture; and, while there is some doubt as to the character of the shock, and also as to the point of impact assuming it to have been a blow, it seems probable that the wound centered about the intersection of the fracture with the lambdoid suture, where the bone is depressed and where the character of the subsequent operation suggests that the outer table was crushed; and the fracture appears to be such as might have been produced by a violent blow at this point. It seems certain that this wound antedated the incision in the scalp, and that this incision was largely exploratory, since it was inaccurately located; and it seems probable that in the early stages the operation on the bone was random. In like manner it seems certain that the operation was abandoned incomplete; for not only is there no indication of finish in the work on the bone, but the scalp remained open when the victim was transferred from the presumptive battlefield to the cemetery; it is certain that he did not survive.

On the whole it appears impossible to regard the operation displayed by this specimen in any other light than as a crude, clumsy attempt, with rude tools, to explore or perhaps to treat a serious wound; and it is unquestionable that either the initial wound or the treatment proved fatal before the operation was complete. It can not, of course, be considered certain that the operation was not early post-mortem, but there is absolutely nothing to indicate this date; and not even the lowliest mind could have designed the cuts and scratches displayed by the bone for the purpose of obtaining portions of the skull for amulets or for any purpose. There is, of course, a possibility that the operation represents a post-mortem examination; but there is neither evidence nor presumption in favor of this supposition.

RIGHT LATERAL ASPECT OF CRANIUM 16, FROM HUAROCHIRI

POSTERO-INFERIOR ASPECT OF CRANIUM 16

Cranium 17

(Plates XXXV, XXXVI)

This is a mummified head, with the scalp remaining on the right side back of the coronal suture and over half of the occiput, while shreds of tissue remain elsewhere; the bones are perfectly preserved and fatty throughout. The skull is hardly so thick and strong as the average of the collection, though the attachments are rugose. The teeth are well developed (the left posterior molar is lacking) and the sutures fairly united, indicating rather early maturity; two interparietal bones (the smaller clearly shown in plate XXXV) interrupt the lambdoid.

The specimen displays a wound and two or three associated operations on the left side. The wound is an irregular splintered fracture, apparently centering just below a point about midlength of the temporo-parietal suture, and 30 or 35 mm. above the auricular meatus. The principal fissure traverses the temporal bone, as shown in plate XXXV, and can be traced in the auricular opening fully 30 mm.; a curvilinear crack some 30 mm. in length crosses this fissure at a large angle 12 mm. above the origin of the zygoma, dying out anteriorly but extending to the suture posteriorly; the third line of fracture evidently coincided with the suture for a distance of some 40 mm.; and a fourth apparently defined the lower margin of the irregular aperture for a length of somewhat over 30 mm. In addition there are traces of another radial fissure extending upward and backward from the central point for a distance of 35 mm.; it defines the upper margin of the triangular fragment loosened by the curvilinear crack and the fracture along the suture, divides the bridge of bone below the circular aperture, and appears in the specimen (and faintly in the reproduction) on the upper posterior side of this aperture. About the center of the wound the bone is considerably depressed.

There were three measurably distinct operations evidently located by the wound. The principal operation was that represented by the approximately circular aperture, which averages 19 mm. in diameter. All about this opening traces of instrumentation appear. The bone is striated in various directions, but for the most part concentrically about the aperture, showing that the operation was finished by scraping or rasping, though whether with or without antecedent incision and elevation can not certainly be determined. On the posterior side the bone is scraped quite thin, though on the anterior side most of the thickness of the inner table forms the margin and is cut through in a nearly vertical direction, showing that here at least there was curvilinear cutting, perhaps subsequent to the scraping. The general appearance of the opening and margins suggests that the operation was completed to the satisfaction of the operator; but the absence of reparative growth and the distinct preservation of the striæ produced by rasping prove that the victim did not long survive.

The second aperture would seem to have been produced by a single operation, probably subsequent to the principal one. It was evidently begun by a rectilinear incision of the usual character, commencing at a point over the temporo-parietal suture (subsequently removed by the conspicuous canoe-shape incision) and below the main aperture, and extending thence forward at least 15 mm. to the main vertical fissure and probably somewhat farther. It was not carried through the bone. There are indications that when the bone was weakened by this incision, an elevator was used to break out two or more fragments, thus producing the triangular aperture. Jagged projections of the inner portion of the bone remained and were not removed, but the outer edges were smoothed by rasping or scraping.

The next operation or step produced a single rectilinear incision 35 mm. in length, 5 mm. wide at the center measured on the outer surface, of the usual V-shape section and terminations, penetrating the bone for a length of 11 mm. and a width of 2 mm. at the center, thus indicating that the instrument invaded the intracranial tissues and probably brought the trials of the victim to an end.

In addition to these definite operations there are several significant scratches, apparently exploratory. The most conspicuous are three or four parallel cuts, the longest 25 mm. in length, extending upward and backward from a point 10 mm. beyond the postero-superior margin of the principal aperture, in a direction approximately parallel with the radial fracture removed in making this aperture (the principal scratch of this series appearing in plate XXXV). Appearances indicate that these scratches originally extended farther downward and forward, and that their extremities were obliterated by the subsequent rasping. A single scratch extends almost directly backward from a point 15 mm. back of the main aperture for a distance of 6 or 7 mm., almost intersecting the upper extremity of a rough groove extending downward 17 mm., and crossing the posterior extremity of the principal rectilinear cut. Two rather conspicuous grooves appear downward and forward from the circular aperture; the more definite extends from the bridge below this aperture backward to the center of the main rectilinear incision. Along the suture below this incision there are conspicuous transverse scratches produced by scraping, rasping, or grinding with a rough edge or surface; and similar marks cross the curvilinear crack forward to the origin of the zygoma, where they unite with the striæ connected with the main operation. The most remote traces of instrumentation are two parallel cuts in the bone just below the temporo parietal suture, 10 mm. from its union with the lambdoid. (Only one of these marks appears in the reproduction.)

The indications of sequence in the operation are somewhat indefinite, though it seems certain that the instrumentation succeeded, and was located by, the wound. It would appear that on dividing and pushing aside the scalp (after the manner indicated by cranium 16), the operator

LEFT LATERAL ASPECT OF CRANIUM 17, FROM TARMA

ANTERIOR ASPECT OF CRANIUM 17

explored the bone extensively, and finally located the uppermost radial fissure, and proceeded to develop the principal aperture, completing the operation by grinding down the sharp edges. It seems probable that shortly afterward, perhaps within a few hours, exploration was extended toward the center of the wound so far as to reveal the fracture following the temporo-parietal suture and the transverse fissure across the temporal bone, and that rude cutting and elevating followed in such manner as to produce the irregularly triangular aperture and widen the opening through the bridge separating it from the circular aperture. Remnants of tissue clinging to the bone below the second aperture and still covering the anterior extremity of the curvilinear track indicate that the scalp and upper portion of the ear were not laid back much below the point of impact on or near the suture; and there are indications that at this stage the exploration was diverted and carried downward and backward across the curvilinear fissure and thence along the posterior portion of the suture, and this work seems to have been followed by the scratching or rasping transverse to the lines of fracture. Undoubtedly the last important step in the operation or series of operations was the development of the canoe-shape incision, which cuts across and interrupts or terminates the striæ and incisions produced in the earlier work; this was apparently the first step in a projected operation of greater extent, which was carried no further, presumptively by reason of the death of the patient, which must have been hastened, or even produced, by the clumsy invasion of the meninges in the central part of the incision. It is barely possible, though by no means probable, that the period intervening between the completion of the principal operation and the beginning of the incomplete treatment was of considerable duration and that the two were not connected with the same wound. There is nothing to indicate that any part of the operation was post-mortem, while the abandonment of cutting at an evidently initial stage in an extensive operation seems explicable only on the supposition that it resulted from death under the knife.

In addition to the lesions about the wound, the cranium reveals an old wound in the form of a deep scratch or groove toward the right margin of the frontal bone, nearly parallel with the coronal suture, extending upward 25 mm. from a point 55 mm. above the outer margin of the orbit.

Cranium 18

(Plates XXXVII, XXXVIII)

This skull is excellently preserved, having been taken from a mummified skeleton, though fleshy tissues are absent save for shreds in some of the cavities. It is quite thick and strong, with remarkably developed and rugose attachments. The bones average 6 or 7 mm. in thickness about the three apertures. The teeth are fairly mature, and the union of the sutures is well advanced, indicating middle age.

The specimen displays three extensive operations of different dates, without trace of antecedent lesion in any case. The earliest operation was located in the upper portion of the left parietal, adjacent to the sagittal suture, centering about 60 mm. back of the coronal; it resulted in a rudely circular aperture now measuring 29 mm. in longest diameter. Save that the margins are beveled from without, no trace of instrumentation remains; the beveled surface has assumed the texture normal to the exterior of the cranium save for radial lines of reparative growth, increasing in strength toward the edges of the aperture. Many strong spicules and knobs of new bone project from the margin, sometimes so much as 3 or 4 mm. into the opening, while the diploe is completely obliterated. The extent of reparative process indicates that the patient survived the operation for years.

The second operation centered 45 mm. below the first, i. e., near the posterior angle of the left parietal, about 42 mm. from the sagittal suture and 35 mm. from the middle line of the lambdoid. It resulted in a rudely circular aperture now about 25 mm. in mean diameter, in every respect comparable with that of the first operation, save that the reparative modification of the bone is less advanced, especially about the upper margin or toward the antecedent opening. The beveled surface shows ridges of growth, but otherwise approximates the aspect of the normal bone, and appearances indicate that the periosteum was developed over it in quite the normal manner. The diploe is almost wholly obliterated, though it can be detected about the antero-inferior margin of the aperture and also toward the junction of the sagittal and lambdoid sutures. While spicular growth is in general less developed than about the earlier aperture, it is particularly well displayed about the inferior margin, where the spicules are at least 2 or 3 mm. in length and sometimes branch or divide into lateral spicules toward the extremity. There can be no doubt that the individual survived this operation also for some, probably several, years, and it is possible that the two were performed about or (just possibly) at the same date.

The third operation was located in the crown, involving the coronal suture, and traversing the sagittal suture near its anterior extremity. In this case fairly definite traces of instrumentation appear. The clearest marks are of such character as to indicate that they were produced by curvilinear incision effected through the use of a blunt single-point instrument wielded by a vigorous hand; and they are so related in position as to suggest that the operator (being right-handed though somewhat ambidextrous) sat on a low bench or bank, holding the head of the patient (lying supine and facing in the same direction as the operator) somewhat inclined forward between his knees; that he then began a curvilinear incision on the right side, swinging his hand strongly toward the left at the forward end of the stroke as the cut was extended and deepened; and that he gradually, with the use of the left hand or both together, carried the incision around to the left and then toward himself, in such manner as to describe an inverted U or

SUPERIOR ASPECT OF CRANIUM 18, FROM CUZCO (TRIPLE-TREPHINED)

LEFT LATERAL ASPECT OF CRANIUM 18

(more exactly) a horseshoe. In the earlier part of the cutting the knife apparently slipped occasionally, particularly toward the heel extremities, though as the incision deepened care was taken to bring these extremities nearer together. Finally, it would appear that the points of the incision were connected by a transverse cut, slightly curved, made with the right hand, slightly oblique to the axis of the horseshoe, as determined by convenience of movement, whereby the aperture was defined. Throughout the instrument was held obliquely, the obliquity increasing with the depth in such manner that the aperture measures considerably larger on the exterior surface than on the interior, while the profile of the cut surface is slightly concave. The aperture averages about 33 mm. in diameter without, and a little over 20 within. It appears rather probable that an elevator was used before the inner table was penetrated, and that the outer table was removed separately, affording greater freedom in extending the incisions through the inner table. After the aperture was opened, the operation was completed by scraping or rasping down the ragged edges produced in making the incisions and smoothing the entire margin of the aperture, evidently with great care, in such manner as to leave a thin projecting edge of the inner table resting on the intracranial tissues. In this final operation the deep scratches due to the slipping of the instrument toward the point of the horseshoe-shape incision were filed out into broad grooves, but two or three exploratory scratches forward of the opening were allowed to remain. Thus the operation was completed, evidently to the satisfaction of the operator; yet it is doubtful whether the patient, already mature or perhaps somewhat advanced in age, survived. While there are no clear indications of reparative process on the surface of the bone, and no unmistakable growth spicules, the diploe seems to be partially obliterated, and there are a few salients along the thin projected margin of the inner table which suggest secondary growth. On the other hand, there is some discoloration of the skull about the aperture, such as might be produced by localized inflammation, perhaps developing into periostosteitis, suggesting that while the patient survived the immediate operation the sequelæ were fatal. It may be observed that this great aperture, opening almost directly over an important sinus, violates in its location the modern rules of trephining, and could hardly be expected to eventuate otherwise than in the death of the victim.

Of the three operations, two were undoubtedly long ante-mortem, while it is practically certain the third was ante-mortem also. Although the instrumentation is indicated only by the last operation, the similarity in form in the three apertures suggests that all were performed in essentially the same way.

Aside from the operations, there are several indications that the individual led an eventful life; there is a deep contusion near the center of the right parietal (shown in plate XXXVII); there is one of the customary supraorbital grooves or scratches near the right side of the

frontal bone extending 32 mm. upward and backward from a point 34 mm. above the outer margin of the right orbit; and there is an irregular contusion in the frontal, 20 mm. to the left of the median line and 50 mm. above the right orbit.

Cranium 19

(Plates XXXIX, XL)

This specimen is the smallest, most fragile, and most delicately molded in the collection; the bone averages 2½ or 3 mm. in thickness about the single immense aperture. It was found invested with the scalp, tendons, and other tissues, but these were mostly removed, leaving only occasional shreds clinging to the bones, particularly in the cavities. The ligament attachments are better developed than in the average Caucasian skull, particularly about the occiput, though less rugose and deeply striated than in most of the specimens. The small dimensions and several other characters suggest femininity. The age is not easily ascertained: The sutures are anchylosed more completely than in any other specimen of the collection, yet the dentition is quite immature; the anterior molars or "seven-year teeth" are barely erupted, and evidently had not appeared through the gums at the time of death; the "wisdom teeth" are rudimentary, being visible through the bone some distance (4 or 5 mm. on the right and twice as much on the left) below the surface; moreover the mandible is short, allowing absolutely no room for the normal eruption of these teeth. On the whole the cranium has an abnormal aspect in several respects. In addition to the lesions appearing about the locus of operation, there is a pronounced indentation, with some crushing and bruising of the bony surface on the left side of the frontal bone 25 mm. from the median line and 40 mm. above the orbit (shown in plate XXXIX); it partially obliterates one of the usual vertical grooves over the temple. A well developed "Inca bone" replaces the superior angle of the occipital.

The remarkable aperture displayed by this specimen extends from near the center of the right parietal forward and downward through the frontal to a point 18 mm. above the center of the right orbit; it is an elongated oval or ellipse 95 mm. in length and 33 mm. in maximum width measured in the plane of the margins, or about 35 by 105 mm. measured on the curved surface of the skull. Many marks of instrumentation appear, though the earlier have been obscured or obliterated by subsequent scraping or filing. Perhaps the most decisive (which unfortunately is not well brought out in the reproduction) is a rectilinear incision 23 mm. long defining the antero-superior margin of the aperture, of which the terminal portions remain. The anterior terminal, 6 mm. in length, is a groove or cut of the usual V-shape section, though more rounded than usual at the bottom, about 1 mm. in width and 1.5 mm. in greatest depth, shallowing and narrowing toward the

ANTERIOR ASPECT OF CRANIUM 19, FROM HUAROCHIRI

tip, beyond which a narrow scratch extends to the transverse fracture limiting the aperture anteriorly, as best shown in plate XXXIX. The medial portion of this incision forms the margin of the aperture for 10 mm., as shown by both illustrations, especially plate XXXIX, though for most of this distance it was not carried entirely through the inner table, a narrow projection of which remains. The posterior terminal of the incision is somewhat obscured by later scraping, yet it is fairly definite for 5 mm. and similar to the better-preserved anterior extremity. Next in clearness is the curvilinear incision marking the postero-median margin of the aperture; as shown by its conformation and by longitudinal striæ, this was made by a rather blunt-pointed and rough-sided instrument, held vertical and reciprocated with a curvilinear movement. For a length of some 15 mm., measured around the curve, it very nearly penetrated the inner table, leaving a thin projecting edge of bone, as clearly shown in plate XL; thence for 10 mm. forward it shallowed in such manner that, when the elevator was used, most or all of the thickness of the inner table remained after the button was dissevered, and still persists, as shown in both reproductions. Nearly as decisive as these cuts is the rectilinear incision defining the lower side of the aperture from the coronal suture well toward the posterior extremity, a distance of about 35 mm. Although the margin of the outer table has been ground away, one side of this incision still retains its original character, and the bottom of the cut for half its length is shown on the narrow selvage of the inner table left to be broken away when the button was lifted; the incision was of the usual character, as shown by conformation and striæ, indicating that it was made with an instrument having a single blunt point and rough sides, operated reciprocally. The entire aperture is circumscribed by scratches and striæ produced in smoothing the rough edges of the bone left by the earlier cutting; yet at several points there are deeper grooves or cuts, evidently made in connection with the main incisions, either in a random way or by the slipping of the tool. The most conspicuous of these are outside the better-rounded posterior extremity of the aperture, and several are in such position as to show the effort made by the operator to change the rectilinear incision last described into a curvilinear incision. The marks left by the grinding or rasping of the margin are rough and irregular, such as might readily be produced by rubbing with a coarse sandstone or quartzite; and there is nothing to suggest the use of specialized or metallic instruments.

The location of the operation coincides with that of an extensive compound fracture, most of the traces of which were evidently removed by the operator. One of the lines of fracture extends downward from the anterior extremity of the aperture to the orbit, and may be traced in the wall of the orbit for about 30 mm., and in the interior of the skull may be followed thence into the nasal bones. A branch fracture defines the anterior extremity of the aperture for 5 mm., and thence

extends horizontally for 16 mm., or nearly to the median line, as shown in plate XXXIX, while immediately above it the tables are separated and a scale of the inner table 6 or 7 mm. across is depressed, as shown in plate XL. The antero-inferior margin of the aperture is defined for 15 mm. back of the vertical fissure by an undercut fracture in which the outer table projects 1 to 3 mm. It seems possible, though by no means probable, that some of this fracturing might have been produced in the operation. Below the posterior portion of the aperture a conspicuous crack in the outer table may be traced from the point at which the margin of the aperture coincides with the coronal suture horizontally backward for about 50 mm., as imperfectly shown in plate XL. There are indications also of a fracture coinciding with the coronal suture 30 mm. downward from the lower side of the aperture. Finally, an irregular crack extends from the posterior margin of the aperture backward for 5 or 6 mm., as faintly shown in plate XL. The character and distribution of these fissures suggest an extensive depressed fracture on the right frontal, at a point nearly opposite the indentation on the left, with radial fissures extending in several directions. There are numerous indications that such a wound was explored rather extensively, either before the operation or in connection with it, especially forward and downward toward the orbit. The clearest marks are three or four horizontal scratches midway between the anterior end of the aperture and the outer angle of the orbit (somewhat indistinctly shown in plates XXXIX and XL); and less distinct marks are found over the superciliary ridge and the adjacent surface of the bone nearly to the median line (as obscurely shown in plate XXXIX).

On considering the various features displayed by the specimen, it becomes evident that the fracture antedated the operation, since (1) most of the lines could not be produced by any conceivable impact against the remaining portion of the skull, while (2) some of the fractures (notably that extending backward from the coronal suture) show indications of subsequent physiologic process. It is certain, also, that the operation was completed to the satisfaction of the operator, since no rough edges of bone were left save a few projections of the inner table, which was necessarily difficult of access. Finally it may be considered as established that the individual survived the operation, since in this case, and this only (so far as the Muñiz collection is concerned), a plate of shell was found fitted to the aperture.[1] Judging from the specimen the operation was not long survived, since there is no definite trace of reparative growth, and since traces of periostitis, apparently connected with the wound or with the subsequent operation, may be detected, especially about the coronal suture below the aperture and along the principal fissure extending backward into the parietal.

[1] Unfortunately this plate, together with all the rest of the collection excepting the nineteen trephined crania, has been destroyed.

RIGHT LATERAL ASPECT OF CRANIUM 19

METHOD OF OPERATING

The twenty-four or more operations exhibited by the nineteen crania reveal clearly and conclusively the methods pursued by the operators. On reviewing the operations, it appears that the methods were simple, comprising three types of manipulation, which were combined in many instances, probably in all of the completed operations. These types are (1) incising, (2) elevating, and (3) rasping (i. e., grinding, filing, or scraping away the bone by a rough-surfaced or irregular-edged instrument).

The incising was of two fairly distinct but intergrading subtypes, (*a*) rectilinear and (*b*) curvilinear. All of the incisions, so far as clearly revealed, both rectilinear and curvilinear, are essentially similar in form; they are V-shape in section and canoe-shape in plan, broadest and deepest toward the middle, where alone they penetrate the bone, shallowing and narrowing toward the extremities, which frequently project beyond the margin of the aperture. The rectilinear incisions are frequently, and the curvilinear cuts commonly, more or less oblique to the tangent plane passing through the point of cutting.

The rectilinear incisions are well displayed in several specimens, either combined in such manner as to describe quadrilaterals, as in crania 1, 2, 3, and 4, or less regularly disposed, perhaps, about the margins of depressed fractures, as in crania 5, 14, 15, and 19, or else distributed at random as in crania 1 (the outlying incision), 16, and 17, in addition to the many examples of minor cutting or scratching described as exploratory.

The development of rectilinear incision into curvilinear cutting is well illustrated by several examples. In cranium 4, three of the six incisions became curved in consequence of the oblique attitude in which the instrument was held by the operator in its passage across the spherical surface of the skull, and a fourth incision was strongly curved toward one of its extremities, evidently because of deflection of the instrument by the superciliary ridge; and one of the random cuts in cranium 16 is curved at both extremities, by reason of rugosities of the surface of the bone, in such manner as to assume a somewhat curvilinear form. In other cases the incisions were evidently curved by studied effort, as most clearly shown in cranium 6. In this case it is clear that the operator began with a rather short vertical and rectilinear incision, which was in one direction developed into a curve, partly by lateral deflection of the instrument at one end of the reciprocal stroke, partly by holding it more obliquely as the cutting proceeded. Of like significance are the partly rectilinear partly curvilinear incisions displayed in crania 7 (the later operation), 18, and 19; while in still other cases, in which the marks of instrumentation have been obscured by subsequent rasping or obliterated by reparative growth, the form of the aperture suggests a similar combination of rectilinear

incision developed into curvilinear cutting, as in crania 9, 11, 12, 13, and 18 (the two earlier operations). In only one case (cranium 8) does the curvilinear cutting closely approach circularity, and even in this case one side is a tangent exceeding half the diameter of the aperture, while there are indications that the final rasping was designed to remove projecting termini and scratches produced in the gradual diversion of an originally rectilinear cut.

Accordingly the first type of manipulation may be traced from simple rectilinear incisions, either random or arranged quadrilaterally, through various combinations of straight and curved cuts up to approximate circularity; in which form, of course, the extent of the lesion and the vital force required for recovery and reparation are reduced to a minimum. It is not known that this sequence has either geographic or chronologic significance; the lowest types (crania 1 and 2) are both from Huarochiri, as is also the highest (cranium 8), and there is nothing save the differentiation in method to suggest difference in period. It is on the whole probable that the differences in refinement in manipulation merely represent varying degrees of skill on the part of essentially contemporary operators.

The elevation of the button outlined and partially dissevered by the incisions is indicated clearly in one case, and with strong probability in at least six others, and is suggested in several additional cases. In cranium 4 one of the margins of the irregular aperture is crushed, splintered, and undercut in such manner as to record unmistakably the application of the elevator lever-fashion over this part as a fulcrum; while the broken edges of the inner table and the margins of the aperture generally were evidently produced by the forcible elevation and breaking outward of the button. In cranium 15 the splinters and fragments of the fractured bone were evidently removed, either entire or in pieces, so forcibly as to leave jagged edges, especially of the inner table, and carry one side of the aperture beyond the incision designed to define it. In cranium 7 (the later operation) the thick button was apparently forced outward by strong pressure exercised by means of an elevator inserted in the incision and used as a lever fulcrumed on the outer wall of bone, whereby one of the margins of the aperture was carried beyond the limiting incision in the inner table; the thin edge of the inner part of the bone about the latest aperture in cranium 18 tells a similar story, and suggests that the tables were separated before the button was finally removed; and equally decisive are the jagged edges of the inner table part of the way around the immense aperture in cranium 19. In crania 1, 2, 5, 12, and 17 also there are jagged margins, especially of the inner table, which could have been produced only by the forcible removal of the button through outward pressure applied by means of an elevator. As with incising, so also with elevating, there are several cases in which no evidence of the process remains; but (excluding the examples of rasping) these are cases in which the marks of instrumen-

tation have been obliterated by subsequent smoothing of edges or physiologic action. There is no case in which traces of incising persist that does not afford suggestion or more decisive proof of the employment of an elevatory process.

The process of rasping is distinctly exemplified by several of the specimens. Perhaps the clearest evidence is that afforded by cranium 16, which displays a complete operation without trace of incision or elevation, apparently produced wholly by rasping, scraping, or grinding. It is true that the outlying marks are for the most part indistinct, but this may be ascribed to increasing delicacy of manipulation as the process was brought to an end—a delicacy attested by the paper-like thinness of the remaining margin of the inner table; and a sufficient number of striæ are preserved to at least suggest the extension of the process over the entire area of this particular operation. In addition, unmistakable marks of rasping or scraping follow the ghastly fissure for at least 50 mm., where they merge into exploratory scratches. In cranium 10 the conformation of the aperture and its margins and the adjacent portions of the skull suggest that the entire operation was performed by rasping or scraping, precisely as in cranium 16, without attendant incision, although in this case all direct traces of instrumentation have been obliterated by reparative process. In cranium 12 (the later operation) the process of rasping or scraping was carried over a considerable area, and one of the three apertures appears to have been produced wholly by this process; and in crania 17 (the upper opening) and 19 the apertures are circumscribed by approximately concentric striæ, showing that the process was employed for working down rough edges. So, too, in crania 7 (the later operation) and 18 (the latest operation) the striæ are so disposed as clearly to indicate that rasping was employed to smooth the bony edges and obliterate the rough projecting kerfs due to irregularity in incision, and the same relation is indicated with almost equal clearness by the striæ about the nearly circular aperture in cranium 8.

Several of the specimens are without traces of rasping or scraping. These fall into two groups, in one of which the operation was evidently incomplete, while in the second the more delicate (at least) of the marks of instrumentation have been obliterated by physiologic process. To the first group belong crania 1, 2, 3, 4, 5, 6, 14, and 15, all of which afford independent indications that the subjects died under the knife, either in consequence of the original lesion or from the effects of the operation. The second group comprises crania 7 (the earlier operation), 13 (both operations), and 18 (the two earlier operations), with more doubtfully crania 9 and 11, in which there is collateral evidence of long survival and extensive reparative process. In every case in which the operation was presumptively complete, and in which traces of instrumentation have not presumptively been obliterated by physiologic action, as well as in several others, rasping is exemplified.

Summarily, it appears that the three processes of incising, elevating, and rasping were commonly and perhaps invariably employed in definite sequence in producing a complete operation; in general, the treatment began with exploratory scraping or cutting and proceeded to definite incision; at a stage determined by the conditions the operator had recourse to elevation and thereby forcibly and often violently dissevered the button; as the operation approached completion the edges of the bone were reduced by rasping or scraping. There are only one or two cases in which there is not either direct or strong presumptive evidence of the process of incising; in most of the cases also there is either direct or strongly presumptive evidence of elevating, and in every suitably conditioned case there is conclusive evidence of rasping.

INSTRUMENTS

More than half of the specimens indicate with considerable clearness the character of the incising instrument and somewhat less clearly the nature of the rasping instrument, while there is little indication concerning the instrument used as an elevator.

The incising instrument evidently possessed a single rather blunt point, without shoulders or other device to limit the depth of cutting; the bluntness is indicated by the width of the bottom of the kerf, which is always rounded or concave for a width ranging from 0.5 mm. to 1.5 mm.; the fact that the point was single is indicated by the frequency with which it slipped toward the termini of the incisions and by the character of the scratches thereby produced, while the absence of shoulder is indicated by the variability in depth of the incisions and by the freedom of the margins of the incisions from striation or other marks of friction in every case in which the details of the operation are clear. In addition to bluntness at the tip, the instrument thickened rapidly in the body, as attested by the somewhat flaring V-shape of the incisions, which are frequently as wide, and never less than half as wide, as deep. The form in plan, section, and longitudinal profile of every well-preserved incision indicates that the single point was operated by a reciprocal motion, so as to form a single-tooth saw, sufficient downward pressure being exercised to cause it to "bite" the bone, and thus produce a kerf having a width determined by the thickness of the instrument, and a length and longitudinal profile determined by the length of stroke and the center of partial revolution of the instrument in the hand of the holder; for in most cases in which the kerf is well preserved the longitudinal profile is more or less concave, indicating that the tip of the instrument moved through a longer radius than its head. Also the well-preserved incisions indicate that the instrument was not only blunt-tipped but rough-sided, for the sides of the kerfs are striated longitudinally, though somewhat irregularly.

There is nothing to suggest in any case that the point of the instrument was round or square, and decisive indications in many cases that

the rather blunt tip expanded longitudinally in the form of a blade considerably broader than thick. The rectilinear incisions give little indication of the relative width and thickness of the tools, but the curvilinear kerfs suggest that the longitudinal width must have been two or three or more times the transverse dimension—i. e., that the tool must have been a blade measuring, at a distance of say 8 mm. from the tip, about 3 or 4 mm. from side to side, and somewhere between 5 and 10 mm. from edge to edge.

It is, of course, impossible to estimate, with any approach to accuracy, the length of the blade, which might or might not have been hafted, but it is practicable to estimate roughly the total length of the instrument, including the haft, if hafted, from the curvature in bottom profile of the incisions, assuming the tool to have been held in convenient fashion in one hand; and such an estimate, based on the well-preserved incisions in crania 1, 2, 14, 15, 16, and 17, ranges from about 50 or 75 to some 150 or 200 mm.; i. e., it seems probable that the instrument was long enough to be handled conveniently in one hand, with the occasional assistance of the other.

Putting the various dimensions together, they are found to define a blade corresponding with an ordinary stone knife or spearhead, or with an arrowpoint attached to a short haft, while the dimensions are inconsistent with those possessed by any known cutting instrument of metal. Considering next the longitudinal striæ in the sides of the kerfs, it appears that they would naturally and necessarily be produced by the reciprocal operation of a knife or spearhead chipped from stone of coarse texture or of such structure as to give a splintery fracture, and that these features would not be produced by any known single-point tool of metal, polished stone, tooth, or shell. Accordingly, the detailed features displayed by the collection afford practically conclusive evidence that the incising instrument was a stone blade of common form and character. There is absolutely no suggestion in any of the specimens that the kerfs were produced by any other kind of tool, either of other material than stone or of other form than a blunt single-tip blade.

Several of the crania indicate that the rasping was effected by an irregularly rough surface, since the striæ are unequal in depth and variable in contour and length. In only a single instance (cranium 8) are the striæ sufficiently uniform even to suggest the use of a regularly formed rasp or file of metal or other tough material, and even in this case careful examination shows that the uniformity is almost certainly due to exceptional shortness of stroke in beveling the narrow marginal zone (1 to 9 mm. in width) of the outer table of the skull. In most cases the striæ are precisely such as those traversing longitudinally the sides of the cuts, and this similarity suggests that they were effected simply by rubbing with the side of a blade chipped from stone of coarse texture or splintery fracture.

In some cases the size of the instrument used for rasping is roughly indicated. The grinding out of the kerf terminals in crania 7 (the later operation) and 18 (the latest operation) produced surfaces curved in two dimensions, of such degree of curvature as to indicate that the instrument must have been about the size of the blade inferred from the incisions; moreover, in cranium 16 the striæ traversing the fracture terminate anteriorly in a series of scratches precisely such as accompany the kerf terminals, suggesting that in this instance, at least, the striæ were produced by the distal portion of a blunt-point instrument corresponding generally to the incising tool.

Accordingly, there is a fairly conclusive body of evidence that the rasping was effected by means of common stone implements, either identical with or closely similar to those used in cutting, and there are no marks which might not be produced by such an instrument, nor is there the least indication that instruments of metal, tooth, or shell were employed, though it is possible that some of the work (e. g., in cranium 10, in which the traces of instrumentation are practically obliterated) might have been performed with other materials than stone, the scraping of the South Sea islanders being suggested.

In the single case in which the bony fulcrum of the elevator is distinctively preserved (cranium 4), the marks indicate merely that the instrument was rough or irregular, rather than smoothly rounded, suggesting that the elevator was nothing more than the stone blade used in making the incision. In several cases, however, there are indications that considerable force was exerted in raising the button, perhaps requiring a tougher material than stone, which suggests that special instruments of tooth, antler, or hard wood might have been employed for this purpose.

It may be noted in passing that the Squier cranium corresponds in indications of instrumentation with crania 1 and 3 of the Muñiz collection, while several of the Cuzco crania indicate the employment of dissimilar methods and distinct instruments; but in the absence of decisive facts, such as can be obtained only by critical examination of the specimens themselves, these examples of Peruvian trephining may be passed over without detailed consideration.

Summarily it appears that the instruments used in performing the operations exemplified in the Muñiz collection were chiefly or exclusively stone implements of the character found among nearly all primitive peoples, including the ancient Peruvians. There is nothing to indicate that the instruments were in any way specialized; there is absolutely no indication of the employment of trephines, saws, or other multiple-point instruments, and only negative suggestions concerning the use of metal.

PROCEDURE OF THE OPERATORS

Some idea as to the technique of Peruvian trephining may be gained from a study of the procedure of the operators, as indicated by the character and sequence of steps in the better revealed operations. There are many indications that the operators were (1) inexpert in manipulation, (2) ignorant of physiology, (3) skilless in diagnosis and treatment, and (4) regardless of the gravity of the operations performed.

As already noted, there was a sequence in refinement of the bone cutting, running from the extravagant quadrangular button with eight projecting kerfs exemplified by cranium 1, and the still more barbarous slashing shown in cranium 5, to the relatively refined circular incision of cranium 8. Yet there is nothing to indicate that the sequence means anything more than a simple transition from the more clumsy to the less. There is scarcely a specimen, not modified by reparative growth, that does not display more or less extended kerf terminals and extensive scratches produced by the slipping of the tool; and the apertures display an irregularity of form attesting unfamiliarity either with geometric proportion in general or with the production of geometric figures by means of the facilities and under the conditions represented by the work. Most of the operations were evidently performed in random fashion without definite plan, by rule of thumb or by no rule at all. There was apparently no uniformity in the orientation of the quadrangular operations save that of convenience in operating, and in several cases (e. g., in the later operation in cranium 7, in cranium 8, and in the latest operation in cranium 18) the outline of the cutting was manifestly determined by the attitude in which the subject was placed. In some of the more refined operations the incising blade was apparently held in such manner as to produce a tapering button and beveled margin, yet most of the rectilinear and some of the curvilinear kerfs indicate that the tool was variously inclined, either through pure clumsiness and inattention, as in the outlying incision in cranium 1, in which (apparently by reason in part of interference with the integument) the tool was inclined at such an angle to the tangent as to require the cutting of bone to nearly twice the normal thickness of the skull, or by effort to keep the hand (and tool) out of the way of vision, as in cranium 8. So, too, when the bony surface was irregular or protuberant the tool was permitted to diverge, regardless of the original direction, as in crania 4 and 16. In short, there is nothing to indicate definite plan or deft execution in any of the operations.

The extravagant incision and violent elevation characterizing many of the operations necessarily rendered the artificial lesions much more extensive and dangerous than necessary, and the frequency with which this needless danger was incurred indicates that the operators had little if any notion of the physiologic processes involved in resistance, recovery, and reparation. In several cases, too, the cutting was carelessly carried entirely through the bony tables so extensively as to

indicate that the tool penetrated the intracranial tissues in such manner that the operation probably became the immediate cause of the death of the victim, as in crania 1, 4, 5, and 17, and perhaps 2, 3, 6, 12 (the later operation), and 15; this highly indefensible procedure apparently growing out of ignorance concerning the delicacy of brain and meninges. Again, the apertures seem to be located altogether at random with respect to the structures affected; no fewer than nine of the twenty-four operations involve sutures, and at least two (crania 13 and 18) were, apparently needlessly, so located as to traverse the sagittal suture about its union with the coronal, thereby endangering especially delicate and conspicuous structures. Several of the operations were, indeed, evidently located by wounds, and these cases might be considered so desperate as to override ordinary prudence; yet a sufficient number are so manifestly ill placed as to indicate that the operator knew not whereof he wrought.

While the inference seems unavoidable that some of the operations were intentionally located by traumatic lesions—indeed, the evidence of cranium 14 alone would appear conclusive on this point, even if it were not corroborated by that of 15, 16, 17, and 19—yet there are a number of examples of aberrant location and erratic exploration. In cranium 1 no trace of antecedent lesion can be found about the locus of operation, though there was an evidently fresh wound, of a severity indicated by fracturing of the outer table, in a remote part of the skull; yet there is no indication of treatment about the wound, while exploratory marks are found 30, 40, and even 50 mm. away from the center of the operation in the four cardinal directions, and the great outlying incision would seem to have been exploratory or experimental. So also the score of widely distributed incisions, with exploratory scratches extending 25 mm. farther, displayed by cranium 5, tell of thoughtless hacking, with no indication of diagnosis or intelligent adaptation of means to ends. The fact that curative treatment was essayed at all in connection with the fearful wound displayed by cranium 16 would appear to indicate utter incompetence in diagnosis; and the fact that the chief treatment was located far from the center of the lesion, and that some of the more ambitious slashes were entirely beyond the region affected by the extensive fracture, strongly indicates absence of diagnosis in the ordinary sense, and demonstrates that the treatment was altogether inapplicable. In cranium 17, too, the operator went far afield in his earlier efforts, and evidently completed an operation that had very little to do with the essential features of a wound which must have displayed conspicuous symptoms, and it is evident that he only approached the real locus of the lesion subsequently, and then in an indefinite and blundering fashion which apparently resulted in the death of the long-suffering subject. These cases of obvious blundering might be doubled or tripled in the collection; they are only typical. Thus there are several examples of glaringly

defective diagnosis and ill-directed treatment, while, with the possible exception of crania 14 and 15 (in which the indications may easily be illusive), no examples are found to prove or even to suggest diagnostic skill—there is much evidence against and no evidence in favor of the competence of the primitive practitioner.

A striking feature of the collection is the magnitude and boldness of the operations displayed by the crania. In one instance (cranium 2) the operator evidently sought to minimize the area affected by his treatment; in another instance (cranium 8) the operation suggests studied economy of vital force; in two cases (crania 14 and 15) the treatment was coextensive with the traumatism; while in three cases (crania 16, 17, and 19) the treatment was more restricted than the antecedent lesion. In nearly all the other cases the treatment seems to have been unnecessarily extravagant, while in several instances (already noted) the cutting was so reckless as almost necessarily to invade the cerebral tissues and occasion the death of the subjects. Even in the three cases in which the antecedent lesion was more extensive than the treatment, the recklessness of procedure is indicated by aberrant location, as well as by the fact that the operation was undertaken in connection with almost necessarily fatal wounds, as must have been clearly indicated by unmistakable conditions and symptoms. So, too, complete disregard of suffering on the part of the patients is attested by the rude and wide-reaching scratches and the violent outwrenching of the buttons, while the extensive wounding of the periosteum was barbarous, largely needless, and wholly irrational. The only definite suggestion of post-mortem operation found in the collection arises in the reckless and inhuman slashing of integument, bone, and brain by evidently needless operations.

In short, Peruvian trephining, as exemplified in the Muñiz collection, can only be regarded as crude in plan and bungling in procedure; and study of the procedure only occasions surprise that the results were not worse, and awakens admiration for the powerful vitality which enabled so large a proportion of the victims to survive.

THE MOTIVE FOR OPERATING

GENERAL INDICATIONS OF MOTIVE

The characteristics of the crania throw some light on the question as to the motives actuating the primitive practitioners of Peru. Sixteen and probably 17 or 18 of the 19 specimens are almost certainly masculine, and represent early and vigorous maturity; all of the well-preserved examples are remarkable for the thickness and strength of the bone and the rugosity of the ligament attachments, while the ill-preserved specimens apparently differ only by reason of the weathering and erosion to which they have been subjected. The first specimen of doubtful gender is the fragmentary cranium 6, which is questionable

only by reason of the fact that the single parietal bone does not admit of satisfactory comparison with the entire specimens; the second is the small and delicately molded cranium 12, which may be feminine; the third is the small specimen of somewhat abnormal appearance (number 19) with mature sutures and immature dentition, which may be feminine also, though it seems quite as probable that it represents an ill-developed male. Collectively the crania appear to represent vigorous and healthy young men, presumptively soldiery; there is every indication of fine physical development, not only in strength of tissue, but in soundness of constitution as indicated by the frequent survival of desperate wounds and even more desperate treatment; yet there is nothing in the crania themselves or in the evidence of the instruments and operations to indicate noteworthy intellectual development.

The individual and collective characteristics indicated by osseous and muscular development are no less clearly shown in the minor traumatic lesions displayed by most of the crania. Cranium 1 displays a late ante-mortem contusion with slight fracture of the frontal bone and, in addition, two long healed grooves over the left temple; cranium 2 reveals a similar groove over the right temple, an extensive indentation of the frontal bone, and two suggestive gashes in the back of the head (perhaps pathologic); cranium 4 exhibits an indentation some 25 mm. in diameter, evidently traumatic, near the center of the right half of the frontal bone; cranium 5 displays traces (partially obliterated by the subsequent hacking of the operation) of the customary vertical groove over the left temple; cranium 7 reveals two such grooves on the left, and two others of exceptional length on the right; cranium 10 has two long parallel grooves, somewhat fresher in aspect than usual, over the right temple, and two others, forming a narrow V over the left temple, with a shorter one placed exceptionally low on either side, or in all six cuts symmetrically grouped; cranium 11 is distorted and greatly flattened in the antero-posterior dimension, and displays the characteristic groove on the right; cranium 12 exhibits an extensive contusion at the summit of the frontal bone, two less extensive indentations near the center of the left half of the same bone, an abnormal scale at the anterior angle of the right parietal, and a long healed groove on the left side of the frontal; cranium 15 displays a completely healed contusion in the center of the frontal, a short gash above the right orbit, and one of the usual grooves above either temple, with a shorter parallel groove on the left; there is in addition a partially healed fracture and indentation of the outer table near the left upper margin of the frontal; cranium 16 displays an immense scar, perhaps of pathologic rather than traumatic origin, a little to the right of the center in the upper part of the frontal, and there are the usual ante-mortem grooves above the temples, that on the left being particularly long and deep; cranium 17 reveals the usual groove on the right, with an inconspicuous corresponding mark on the left; cranium 18 is indented by a deep groove of the usual character over the right temple, and displays a considerable

though not very deep scar midway between the left orbit and the crown, and a deeper scar near the center of the right parietal; while cranium 19 shows an inconspicuous mark of the usual character over the left temple, and in addition a considerable contusion by which the outer table is somewhat crushed and both tables depressed. These unmistakable records of traumatic history are additional to the operations, single and multiple, and to the more or less extensive wounds with which several of them are connected. There are accordingly four classes of traumatic injuries represented, viz, (1) those produced by the trephining, (2) the antecedent fractures displayed by five of the crania, (3) the curious grooves over the temples exhibited by most of the specimens, and (4) the miscellaneous indentations and bone scars displayed by fully half the crania. Excluding the first three classes, the 19 specimens display no fewer than 14 traumatic lesions resulting from injuries to the head, which were more or less serious, yet always of such severity as to leave clear traces in the bony structure; and nearly all of these were anterior. The five wounds of the second class were of such severity as almost necessarily to be mortal. This remarkable record of accident indicates that the individuals lived eventful albeit short lives, and were inured to blood and pain and accustomed to facing danger. The peculiar scoring above the temples (of which 23 examples are displayed by the 17 frontal bones) is much too regular to be ascribed to fortuitous wounding; without examination of a larger number of crania and careful consideration of their associations, these marks may not safely be interpreted; yet it may be suggested (the suggestion arising in analogies with other American aborigines) that they are records of ceremonial observances in which wounds were inflicted on young men chosen for initiation into militant or other orders. The scars indicate lesions no more serious and probably less painful than those of the Mandan and Hidatsa tribes of North America, while some of the Pueblo Indians, who are still more closely connected in culture with the South American peoples, have initiatory ceremonies involving symbolic wounding of the head, which can only be regarded as the vestige of an archaic custom of actual wounding in the initiation. So, too, the "scarred skulls from Florida," recently brought to light by Cushing, are marked by regular ridges of papuloid bony growth, which seem to have resulted from the cicatrization of the scalp; the inference being that the marks were made in producing a permanent symbolic crest of hair, supplemented by feathers, etc., to distinguish the warriors.[1]

Some indications of motive may be found in the antiquity of the collection, as evidenced by the methods of operating. In every case in which the marks of instrumentation are preserved they point clearly and unmistakably to the use of primitive tools, mainly or wholly of stone; there is no suggestion of the slightest value that metal was used in any part of the treatment; and while there is a certain similarity

[1] American Anthropologist, volume x, 1897, pp. 17–18.

running through all trephining operations, there is not the slightest indication that these primitive operations were influenced by the refined methods of civilization, and strong indications that some of them—notably the operations by rectangular cutting—were autochthonous. Accordingly the inherent evidence of the collection appears to prove that all of these cases of trephining antedated the advent of white men, and were thus essentially prehistoric.[1]

Another indication of motive may be derived from the period of the operation with respect to the life of the individual treated. Out of the 24 cases represented by distinct operations, 8—recorded by crania 7 (two operations), 10, 12 (the earliest operation), 13 (two operations), and 18 (the two earlier operations)—survived long enough to permit more or less extensive reparative changes and considerable bony growth, while 6 other cases—recorded in crania 8, 9, 11, 12, 18 (the third operation), and 19—apparently survived for days or months, and in some cases perhaps for years. Excluding the case exemplified by cranium 19 (in which the antecedent lesion was almost necessarily fatal) this gives a ratio of 13 survivals out of 24 operations, or a percentage quite as high as that of modern practice. In one case (that exemplified in cranium 16) it is clear that the patient died under the operation, and that the treatment was abandoned without closing the integument; in at least 2 cases (those of crania 1 and 5) there is practically conclusive evidence in the condition of the bone that the victim died in or very soon after the operation; while in 3 other cases (recorded in crania 14, 15, and 17) the relation between the cutting and evidently antecedent wounds indicates that the patients died in the hands of the operators. Accordingly, in 6 (7 if cranium 19 be reckoned) out of 23 cases, either the operations or the immediately antecedent lesions were undoubtedly fatal. In one case (represented by cranium 2) death seems to have supervened on an operation connected with the diseased condition of the bone; and there remain 3 cases (those of crania 3, 4, and 6) in which the state of preservation is hardly such as to indicate the relation of the operations to the life of the individual with certitude, though in two of these there is forcible suggestion of death under the knife. On the whole, it is certain that over half of the operations were long ante-mortem, and that most of the remainder were ante-mortem at least in their inception, and there is not the slightest indication, except in the otherwise explicable rudeness of the treatment, that any of the operations were post-mortem.

Still another indication concerning motive appears in the form and character of the buttons or bony fragments removed by the operators.

[1] It may be noted that the above inference from the trephined crania is in accord with voluminous and indubitable evidence obtained by Dr Muñiz that all of the arts of the people represented by the crania were archaic, and of prehistoric type exclusively—indeed, according to Dr Muñiz, the associations clearly indicate not only a pre-Spanish but a pre-Incan age for the ancient trephiners. The only notable suggestion of less antiquity is that of the designation given by Squier to the skull obtained by him from Señora Zentino, and said to have been taken some time before from an "Inca cemetery in the valley of Yucay" ("Peru—Incidents of Travel and Exploration in the Land of the Incas," 1877, page 456); and it is clear that in this case the evidence of Incan age is far from complete.

Cranium 4 displays cutting in such manner as to describe four irregularly rectangular bits of bone, while the work on cranium 5 yielded a still larger number of still more irregular fragments. The operation exemplified by cranium 8 may, indeed, have yielded a circular button, but considerable additional bone was removed in minute shreds by subsequent rasping. If the operation in cranium 10 was performed wholly by scraping, as appearances indicate, then all of the dislodged bone came away in shreds or filings; in the later operation or operations on cranium 12 most of the bony matter seems to have been removed by scraping; in cranium 14 bony splinters only were removed, and in cranium 15 such splinters in connection with a probably broken bony tongue of irregular form. So, too, in all the other cases there are unmistakable indications that the purpose of the operator was to produce an aperture, and not to obtain bone fragments of any particular form or size; and there is not the slightest indication in any of the specimens that the cutting was designed to yield rondelles.[1]

SPECIAL INDICATIONS OF MOTIVE

Strong yet somewhat illusive light is thrown on the motives actuating the prehistoric practitioners of Peru by the relations between trephining and traumatic lesions. In 6 cases (exemplified by crania 6, 14–17, and 19) the operations were evidently located by grave wounds. The 13 remaining crania display 18 operations having no traceable connection with lesions, while, as already enumerated, no fewer than 14 scars of more or less serious wounds (some of considerable gravity) are displayed, none of which were treated by trephining. The 23 examples of manifestly intentional wounding of such severity as to leave bone scars over the temples may be neglected. Accordingly it appears that, while there are a few cases of indubitable connection between operation and antecedent lesion, this relation is subordinate—in most cases the cranial lesions did not lead to trephining, while in the great majority of cases the trephining was apparently not connected with traumatic lesion. In one case (cranium 2) there is a strong suggestion that the operation was connected with pathologic lesion; yet this case does not materially affect the relations between lesion and trephining. The relations may perhaps best be summarized by the statements (1) that most of the operations were independent of cranial wounds so far as can be ascertained; (2) that most of the cranial lesions were not followed by trephining; and (3) that only wounds of great severity were followed by cranial treatment.

On considering specially the six crania (6, 14–17, and 19) displaying operations located by immediately antecedent wounds, they appear to

[1] This inference from the crania is in accord with the general results of Peruvian collecting by Dr Muñiz and others. Among the many thousand specimens representing the apparel, ornaments, and other personal appurtenances found by Dr Muñiz in connection with more than a thousand skeletons, and despite constant search, not a single rondelle or other object made from human cranial bone was found; and no record of the discovery of such objects by any of the numerous students of Peruvian archeology is known.

fall into three categories. In the first category, represented by crania 6, 14, and 15, the operations were located by depressed fractures of considerable gravity, and the procedure, albeit clumsy, was of such character as to tend to afford relief—i. e., the wounds were such as modern practitioners would treat by cranial cutting, including the removal of bony splinters, the excision of rough edges, and the elevation of the depressed bone, in a manner corresponding fairly with the primitive procedure. Accordingly, if these cases stood by themselves, they would appear to indicate rational therapeutic surgery; and the indication of the operation coinciding with pathologic lesion (cranium 2) is similar. The second category is represented by cranium 19, in which the wound was apparently a depressed fracture, with extensive stellate fissuring—i. e., a wound in which trephining would be indicated to modern practitioners, unless the symptoms permitted diagnosis of the great extension of one of these fissures through the orbital and nasal bones. Accordingly, this example also suggests rational therapeutic motive, and the suggestion is greatly strengthened by the use of a plate. In the third category, represented by crania 16 and 17, on the other hand, the treatment was not only barbarous and clumsy, but ill directed. In the first example the wound was of such character as to contraindicate trephining, while in the second it was of such nature as to require a treatment quite different from that adopted. As already noted, this and several other cases demonstrate ignorance of physiology and etiology on the part of the operators. They might, perhaps, be regarded as representing the efforts of specially bungling practitioners, though there is nothing save the treatment in the three or four foregoing cases to suggest greater skill on the part of any of the practitioners; and accordingly these examples can hardly be considered to represent a rational therapeutic surgery. On the whole, this group of crania, taken by themselves, appear at first sight, albeit somewhat doubtfully, to represent definite therapeutic treatment; yet it is to be observed that their testimony is indicative or merely suggestive rather than conclusive.

On considering the outcome of the treatment exemplified in the six cases, a significant relation appears—three of the victims died under the knife early in the operation, two more died before the aimless hacking and scraping was completed, and the sixth died after the operation was completed but before the beginning of reparative process in the bone. Thus none of the subjects of the suggested therapeutic treatment survived. It is true that in three of the cases the wounds were almost necessarily fatal, and that in the others they were so serious as probably to result fatally without prompt and judicious treatment, yet the fact remains that the collection shows absolutely no basis for the encouragement of trephining as a therapeutic treatment for traumatic lesions.

Accordingly, on full consideration of all of the facts and relations displayed by the group of crania in which the operations were located

by antecedent wounds, the question arises whether—superficial indications to the contrary notwithstanding—there is any definite indication that the trephining was therapeutic; on the one hand, there is (1) the association in place and the sequence in time of lesion and cutting, and (2) the fact that in two or three cases trephining was adapted to the relief of the wound; on the other hand, there is (1) the aberrant location of the cutting and the reckless exploration in two cases; (2) the ignorance of physiology and etiology demonstrated by these and other specimens, and (3) the invariable failure of the operation, regarded as a curative treatment. On the whole, it would appear, even when attention is confined to the inherent evidence of this most suggestive portion of the collection, exceedingly doubtful whether the cranial cutting can justly be considered therapeutic.

Neglecting cranium 2 (in which there are doubtful indications of location of the operation by pathologic lesions), there remain 11 crania, displaying 16 operations, none of which can be traced to antecedent lesions of any sort. In these cases, therefore, there is no suggestion of motive. Accordingly, it seems needful and unobjectionable to seek explanation of these operations in the records concerning other peoples of corresponding cultural development. For immediate explanation, it will suffice to consider the primitive operation performed among the South Sea islanders by scraping with stone or shell and covering with plates of cocoanut shell. Among them the operation is not designed to relieve traumatic lesions, so far as the records show, but to relieve various neural and cerebral disorders, such as vertigo and even simple headache; and the operation is performed by the shaman. Now, while the records concerning the South Sea islanders are adequate so far as procedure and results are concerned, there are clear indications that the recorders did not so fully enter into the ideas of the operators as to understand the motives by which they were actuated; but the motives can easily be inferred from those actuating the shamans among other peoples of the same culture-grade. Among the Indians of North America and South America, among the Australian aborigines, among several native African tribes, and among different Eurasian peoples after the dawn of history, the shamanistic diagnosis and motive were closely similar. The medicine-man ascribed the disorder to an evil "mystery," often an imaginary worm, sometimes an inanimate foreign body, lodged in the flesh, bone, marrow, brain, or intestines of the sufferer, and the treatment consisted in the exorcism or extraction of the foreign organism or substance by incantation, sometimes accompanied by local manipulation or other treatment; and among those tribes in which this notion of disease and its treatment culminated, the imaginary maleficent organism or substance was commonly symbolized by an actual worm or grub, or a pebble, or a bit of wood or other substance, which the shaman dexterously manipulated in such manner as to convey to the lay observers the impression that it was taken from the body of the sufferer. As

culture advanced, the materialization or incarnation of the evil "mystery" declined, yet the primitive theory of disease persisted long, and indeed crops out today in the lower strata of civilization in every country on the globe; and medicine-men and medicine-women, wearing the mantles of the shamans of old, treat disease by incantation and exorcism, perhaps accompanied by simple medication or manipulation, which not infrequently chances to be beneficial. Thus, although the records of trephining among the South Sea islanders are in one respect incomplete, there can be little doubt as to the motive underlying the operation. Interpreted in the light of invariable ideation among primitive peoples, the motive must be considered thaumaturgic, and the actuating idea the design of liberating some maleficent "mystery" by a ceremonial incantation grown into local treatment of unusual severity; and in view of the unanimity of motive among all primitive peoples, so far as known, it seems not only just and safe but necessary to ascribe to the ancient practitioners of Peru the motives of other American Indians as well as the methods of the South Sea islanders. Thus the 16 apparently erratic and aimless operations displayed in these 11 crania find a rational and adequate explanation; the treatment may have been for vertigo, headache, or other disease; for coma, produced by shocks or blows of such character as to leave no marks, or for trifling wounds; but it is safe to consider the trephining thaumaturgic and (albeit perchance beneficial) wholly independent of physiologic knowledge and etiologic skill.

On considering the relation of this group of operations to individual history, it appears that at least 6 out of 16 were so far successful that the subjects survived for years, as attested by growth of bone, and that at least 4 and perhaps 5 more survived for shorter periods, giving a ratio of success quite as high as that attending modern practice; so that, whatever the motive in detail, there was adequate prestige for the practitioners and adequate encouragement for continuing the practice.

Recurring now to the 5 or 6 crania displaying antecedent lesions associated with the operations, and considering the cases in the light of the almost inevitable inferences concerning contemporary treatment in other cases, a suggestion arises as to the special motive in these individual cases. The suggestion is that the victims were treated not so much for the wounds, which the skilless practitioner was unable properly to diagnose, as for the symptoms attending the lesions. Pursuing this suggestion, it appears that in every case the wounds were of such character as to produce coma, delirium, or other functional derangement so serious as completely to control the conduct of the individual—i. e., to produce in exaggerated degree such disorders as are habitually treated by the South Sea islanders. Assuming the treatment to have been actuated in this way, its localization, sometimes accurate but as often erratic, is easily understood; for no shaman is so completely dominated by his ideals as to neglect local indications. A parallel case in which

a gangrenous wound in the foot of an Indian was treated by incision through the flesh and scraping of the bone in order to extract a maleficent maggot has been recorded by Cushing.[1]

CLASSIFICATION OF PERUVIAN TREPHINING

On reviewing the foregoing evidence as to the culture-grade and antiquity of the Peruvian practitioners whose professional work is recorded in the Muñiz collection, it becomes clear that the instruments were chiefly or wholly of stone, and hence that the culture-grade was uncivilized; and since the use of metal quickly followed the Spanish invasion, it follows that the trephining must be considered prehistoric. This conclusion is sustained and established by the associations with the other products of Dr Muñiz' work.

On reviewing the evidence as to method, it appears that there is no indication of the use of differentiated instruments or of skillful procedure. It follows that the trephining must be regarded as primitive rather than specialized; and, since the operation is known from collateral evidence to have been performed in prehistoric times, it must be regarded as archaic.

On reviewing the indications of motive, it is found that the evidence is somewhat vague and illusive, yet, when considered comparatively, fairly satisfactory. There are suggestions of therapeutic treatment in a few of the crania, yet on the whole stronger indications that even in these cases the operations were thaumaturgic, while in the great majority of the specimens the operations can only be interpreted as wholly thaumaturgic; and, since there is nothing to indicate different culture-grades or differentiated methods, it seems necessary to conclude that all the operations belong to the earlier stage in the development of sophiology, and were essentially thaumaturgic. It is clear that most of the operations were ante-mortem, and there is nothing to indicate that any were post-mortem. At the same time there is, in several cases, conclusive evidence that the motive for the treatment was connected—albeit in a thaumaturgic way—with the individual treated,

[1] This case is especially significant as an indication of theory and procedure in primitive surgery. The disorder was a tumor resulting from a local bruise, so advanced as to disorganize tissues and threaten general septicemia. The theory was that a "mysterious" maggot or worm, burrowing in flesh or bone, caused this disorder. The treatment was wholly thaumaturgic in plan, though partly (and incidentally) therapeutic in procedure. It began with the making of scalpels and lancets from bottle glass and obsidian, and with many incantations; next the tumor was cleansed; then a T-shape incision was made in such manner as to lay open the tumor, and the pus and serum were removed and the gangrenous tissue cut away, exposing the bone, with discolored periosteum, which was carefully scraped. At this stage a fetich, symbolizing the "mysterious" maggot, was laid in the wound and presently removed ceremoniously. Afterward the wound was repeatedly cleansed, sprayed with a red infusion of willow-root bark, and dried with scraped buckskin; finally the openings were stuffed and closed with piñon gum and neatly bandaged, the dressing being dusted with an astringent yellow powder. The infusion, gum, and powder were antiseptic, and combined with the excision of diseased tissue to effect a cure; yet the theory controlling the use of these substances was no more rational than the primary diagnosis: The red infusion symbolized healthy blood or vitality, the gum symbolized constructive process (in prescriptorial ideation), and the powder symbolized fructifying pollen. The complete cure was due partly to subsequent dieting, which was incidentally hygienic, though the design was, like that of the treatment, wholly symbolic or thaumaturgic. The bearing of this case on primitive trephining is manifest. ("A Case of Primitive Surgery," *Science*, N. S., vol. v, 1897.)

while there is not the slightest indication that the operation was vicarious in any case. Accordingly the motive must be subclassed as sortilegic.

SIGNIFICANCE OF PERUVIAN TREPHINING

As set forth on earlier pages, trephining began in early prehistoric times, and was performed after death for the purpose of obtaining amulets. It seems necessary to conclude that the operation was gradually extended to living captives for the same vicarious purpose, and it seems certain that the operation was extended in turn to others than captives for slightly modified yet still essentially vicarious purposes. On this part of the development of trephining the Peruvian specimens do not seem to bear directly.

As noted above incidentally, there is an important stage in the development of medical and surgical practice in which the motive is wholly thaumaturgic, yet in which the incantation is accompanied by medication or manipulation; and it may be added that there are numberless known instances in which the manipulation is of great severity, extending to scarification, penetration of the tissues, incision of the bone, and actual trephining. Sometimes the manipulation is beneficial, when the prestige of the shaman grows, and the aimless operation is thereby encouraged until, if frequently successful, it grows into empiricism, the forerunner of scientific medicine. There is thus a gradual transition from purely thaumaturgic manipulation into empiric surgery. Now, it would appear that the Peruvian trephining represents some stage in this transition; and nothing more than inspection of the ill-planned, clumsy, and extravagant cutting is required to show that the stage was early, and that the empiricism in which the pupil imitates the teacher and the son the sire could hardly have been reached. Accordingly, Peruvian trephining marks one of the stages in the development of this branch of medical treatment, and indeed of medical treatment in general; and it falls in place with the other known instances of primitive trephining, running from the vicarious operation of prehistoric times to the empiric operation of the present day, to illustrate and demonstrate the rise of the art of trephination.

As already noted, trephining is perhaps the boldest feature of modern surgery; and it may be characterized as the only feature of modern surgery which is known to be of great antiquity. Accordingly, trephining may be considered to represent the trunk of the genetic tree of surgery, and the history of trephining may fairly be considered to represent the history of surgery, at any rate until within recent decades; and this history demonstrates that at least the major operations of surgery were in the beginning performed on the dead, later on those whose lives were deemed worthless, and only in relatively modern periods for the alleviation of suffering and the prolongation of life. Thus the Peruvian collection is of special note as a record of an important period in the unwritten history of surgery.

THE CLIFF RUINS

OF

CANYON DE CHELLY, ARIZONA

BY

COSMOS MINDELEFF

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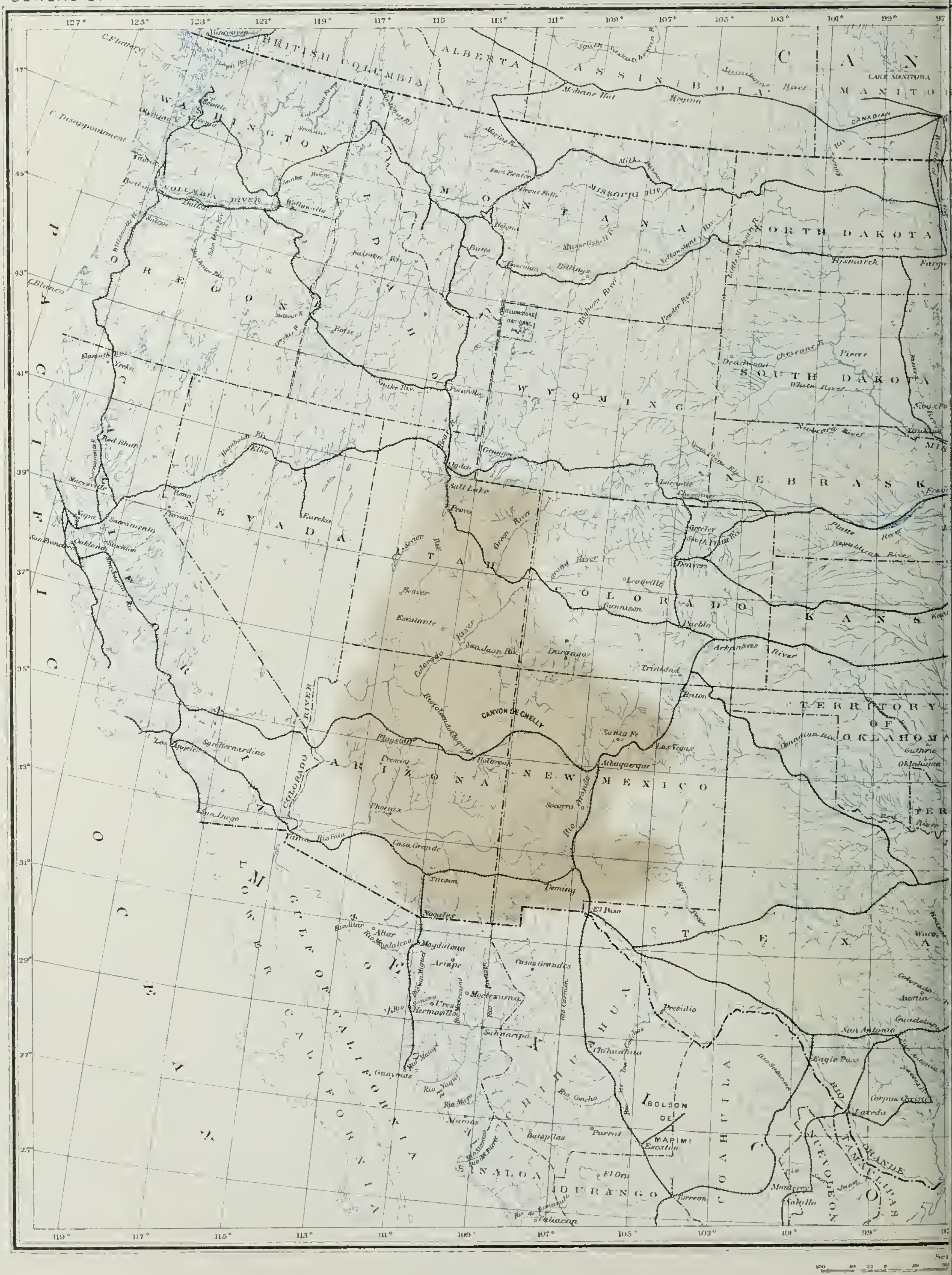
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MANITOBA
LAKE MANITOBA
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WASHINGTON
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SOUTH DAKOTA
OREGON
WYOMING
NEBRASKA
NEVADA
UTAH
COLORADO
KANSAS
CALIFORNIA
ARIZONA
NEW MEXICO
TERRITORY OF OKLAHOMA
TEXAS
PACIFIC OCEAN
LOWER CALIFORNIA
GULF OF CALIFORNIA
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
SINALOA
DURANGO
BOLSON DE MAPIMI
YELLOWSTONE NATIONAL PARK
CANYON DE CHELLY
COLUMBIA RIVER
MISSOURI RIV.
COLORADO RIVER
RIO GRANDE
C. Flattery
C. Disappointment
C. Blanco
Seattle
Portland
Salem
Dalles
Walla Walla
Spokane
Boise
Helena
Butte
Bozeman
Billings
Fort Benton
Great Falls
Medicine Hat
Regina
Bismarck
Fargo
Pierre
Deadwood
Pocatello
Ogden
Salt Lake
Provo
Granger
Cheyenne
Laramie
Greeley
Denver
Leadville
Gunnison
Pueblo
Trinidad
Raton
Durango
Beaver
Escalante
Green River
Grand River
San Juan Riv.
Arkansas River
Platte River
Republican River
Elko
Eureka
Reno
Carson
Marysville
Sacramento
Napa
Oakland
San Francisco
Stockton
Red Bluff
Yreka
Los Angeles
San Bernardino
San Diego
Yuma
Rio Gila
Flagstaff
Prescott
Holbrook
Phoenix
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Tucson
Nogales
Deming
Socorro
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Presidio
Chihuahua
Parral
Escalon
Torreon
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Batopilas
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Hermosillo
Ures
Moctezuma
Arispe
Magdalena
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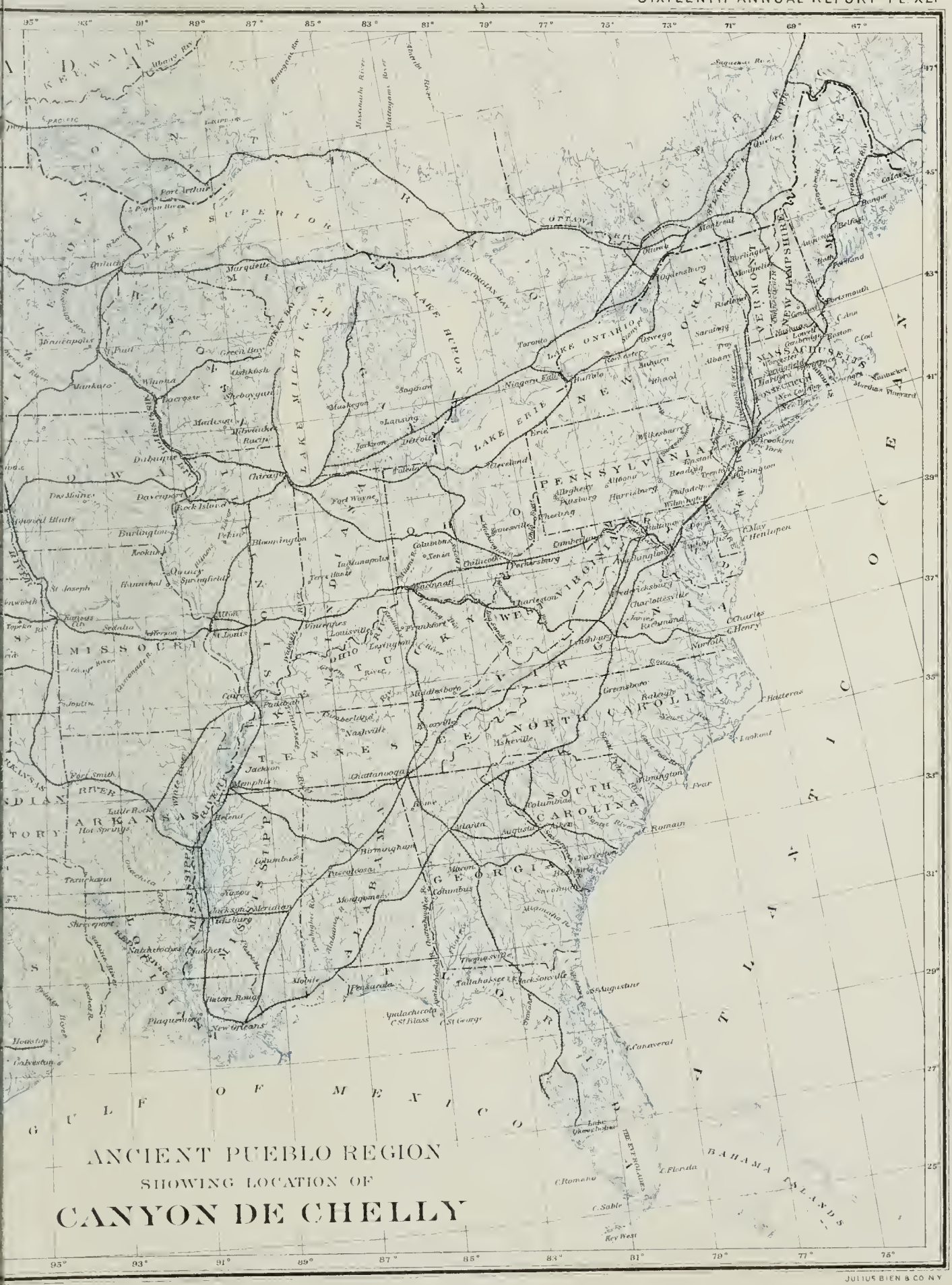

ANCIENT PUEBLO REGION
SHOWING LOCATION OF
CANYON DE CHELLY
JULIUS BIEN & CO. N.Y.

THE CLIFF RUINS OF CANYON DE CHELLY, ARIZONA

By Cosmos Mindeleff

INTRODUCTION

HISTORY AND LITERATURE

Although Canyon de Chelly is one of the best cliff-ruin regions of the United States, it is not easily accessible and is practically unknown. At the time of the conquest of this country by the "Army of the West" in 1846, and of the rush to California in 1849, vague rumors were current of wonderful "cities" built in the cliffs, but the position of the canyon in the heart of the Navaho country apparently prevented exploration. In 1849 it was found necessary to make a demonstration against these Indians, and an expedition was sent out under the command of Colonel Washington, then governor of New Mexico. A detachment of troops set out from Santa Fé, and was accompanied by Lieutenant (afterward General) J. H. Simpson, of the topographical engineers, to whose indefatigable zeal for investigation and carefulness of observation much credit is due. He was much interested in the archeology of the country passed over and his descriptions are remarkable for their freedom from the exaggerations and erroneous observations which characterize many of the publications of that period. His journal was published by Congress the next year[1] and was also printed privately.

The expedition camped in the Chin Lee valley outside of Canyon de Chelly, and Lieutenant Simpson made a side trip into the canyon itself. He mentions ruins noticed by him at 4½, 5, and 7 miles from the mouth; the latter, the ruin subsequently known as Casa Blanca, he describes at some length. He also gives an illustration drawn by R. H. Kern, which is very bad, and pictures some pottery fragments found near or in the ruin. The name De Chelly was apparently used before this time. Simpson obtained its orthography from Vigil, secretary of the province (of New Mexico), who told him it was of Indian origin and was pronounced *chay-e*. Possibly it was derived from the Navaho name of the place, Tsé-gi.

[1] Thirty-first Congress, first session, Senate Ex. Doc. No. 64, Washington, 1850.

Simpson's description, although very brief, formed the basis of all the succeeding accounts for the next thirty years. The Pacific railroad surveys, which added so much to our knowledge of the Southwest, did not touch this field. In 1860 the Abbé Domenech published his "Deserts of North America," which contains a reference to Casa Blanca ruin, but his knowledge was apparently derived wholly from Simpson. None of the assistants of the Hayden Survey actually penetrated the canyon, but one of them, W. H. Jackson, examined and described some ruins on the Rio de Chelly, in the lower Chin Lee valley. But in an article in Scribner's Magazine for December, 1878, Emma C. Hardacre published a number of descriptions and illustrations derived from the Hayden corps, among others figures one entitled "Ruins in Cañon de Chelly," from a drawing by Thomas Moran. The ruin can not be identified from the drawing.

This article is worth more than a passing notice, as it not only illustrates the extent of knowledge of the ruins at that time (1878), but probably had much to do with disseminating and making current erroneous inferences which survive to this day. In an introductory paragraph the author says:

> Of late, blown over the plains, come stories of strange newly discovered cities of the far south-west; picturesque piles of masonry, of an age unknown to tradition. These ruins mark an era among antiquarians. The mysterious mound-builders fade into comparative insignificance before the grander and more ancient cliff-dwellers, whose castles lift their towers amid the sands of Arizona and crown the terraced slopes of the Rio Mancos and the Hovenweap.

Of the Chaco ruins it is said:

> In size and grandeur of conception, they equal any of the present buildings of the United States, if we except the Capitol at Washington, and may without discredit be compared to the Pantheon and the Colosseum of the Old World.

In the same year Mr J. H. Beadle gave an account[1] of a visit he made to the canyon. He entered it over the Bat trail, near the junction of Monument canyon, and saw several ruins in the upper part. His descriptions are hardly more than a mention. Much archeologic data were secured by the assistants of the Wheeler Survey, but it does not appear that any of them, except the photographer, visited Canyon de Chelly. In the final reports of the Survey there is an illustration of the ruin visited by Lieutenant Simpson about thirty years before.[2] The illustration is a beautiful heliotype from a fine photograph made by T. H. O'Sullivan, but one serious defect renders it useless; through some blunder of the photographer or the engraver, the picture is reversed, the right and left sides being interchanged, so that to see it properly it must be looked at in a mirror. The illustration is accompanied by a short text, apparently prepared by Prof. F. W. Putnam, who edited the volume. The account by Simpson is quoted and some

[1] Western Wilds, and the Men who Redeem Them; Cincinnati, Philadelphia, Chicago, Memphis, 1878.

[2] U. S. Geog. Surveys West of the 100th Meridian, Lieutenant George M. Wheeler in charge; reports, vol. VII, Archæology; Washington, 1879, pp. 372–373, pl. XX.

additional data are given, derived from notes accompanying the photograph. The ruin is said to have "now received the name of the Casa Blanca, or White House," but the derivation of the name is not stated.

In 1882 Bancroft could find no better or fuller description than Simpson's, which he uses fully, and reproduces also Simpson's (Kern's) illustration. In the same year investigation by the assistants of the Bureau of Ethnology was commenced. Colonel James Stevenson and a party visited the canyon, and a considerable amount of data was obtained. In all, 46 ruins were visited, 17 of which were in Del Muerto; and sketches, ground plans, and photographs were obtained. The report of the Bureau for that year contains an account of this expedition, including a short description of a large ruin in Del Muerto, subsequently known as Mummy Cave. A brief account of the trip was also published elsewhere.[1] The next year a map of the canyon was made by the writer and many new ruins were discovered, making the total number in the canyon and its branches about 140. Since 1883 two short visits have been made to the place, the last late in 1893, and on each trip additional material was obtained. In 1890 Mr F. T. Bickford[2] published an account of a visit to the canyon, illustrated with a series of woodcuts made from the photographs of the Bureau. The illustrations are excellent and the text is pleasantly written, but the descriptions of ruins are too general to be of much value to the student.

In recent years several publications have appeared which, while not bearing directly on the De Chelly ruins, are of great interest, as they treat of analogous remains—the cliff ruins of the Mancos canyon and the Mesa Verde. These ruins were discovered in 1874 by W. H. Jackson and were visited and described in 1875 by W. H. Holmes,[3] both of the Hayden Survey. This region was roamed over by bands of renegade Ute and Navaho, who were constantly making trouble, and for fifteen years was apparently not visited by whites. Recent exploration appears to have been inaugurated by Mr F. H. Chapin, who spent two summers in the Mesa Verde country. Subsequently he published the results of some of his observations in a handsome little volume.[4] In 1891 Dr W. R. Birdsall made a flying trip to this region and published an account[5] of the ruins he saw the same year. At the time of this visit a more elaborate exploration was being carried on by the late G. Nordenskiöld, who made some excavations and obtained much valuable data which formed the basis of a book published in 1893.[6] This is the most important treatise on the cliff ruins that has ever been published, and the illustrations can only be characterized as magnificent. All of these works, and especially the last named, are of great value to the student of the cliff ruins wherever located, or of pueblo architecture.

[1] Bull. Am. Geog. Soc., 1886, No. 4; Ancient Habitations of the Southwest, by James Stevenson.
[2] Century Magazine, October, 1890, vol. XL, No. 6, p. 896 et seq.
[3] U. S. Geol. Survey, F. V. Hayden in charge; 10th Ann. Rept. (for 1876), Washington, 1878.
[4] The Land of the Cliff Dwellers, by Frederick H. Chapin; Boston, 1892.
[5] Bull. Am. Geog. Soc., vol. XXIII, No. 4, 1891; The Cliff Dwellings of the Cañons of the Mesa Verde.
[6] The Cliff Dwellers of the Mesa Verde, by G. Nordenskiöld; Stockholm and Chicago, 1894.

GEOGRAPHY

The ancient pueblo culture was so intimately connected with and dependent on the character of the country where its remains are found that some idea of this country is necessary to understand it. The limits of the region are closely coincident with the boundaries of the plateau country except on the south, so much so that a map of the latter,[1] slightly extended around its margin, will serve to show the former. The area of the ancient pueblo region may be 150,000 square miles; that of the plateau country, approximately, 130,000.

The plateau country is not a smooth and level region, as its name might imply; it is extremely rugged, and the topographic obstacles to travel are greater than in many wild mountain regions. It is a country of cliffs and canyons, often of considerable magnitude and forming a bar to extended progress in any direction. The surface is generally smooth or slightly undulating and apparently level, but it is composed of a series of platforms or mesas, which are seldom of great extent and generally terminate at the brink of a wall, often of huge dimensions. There are mesas everywhere; it is the mesa country.

Although the strata appear to be horizontal, they are slightly tilted. The inclination, although slight, is remarkably persistent, and the thickness of the strata remains almost constant. The beds, therefore, extend from very high altitudes to very low ones, and often the formation which is exposed to view at the summit of an incline is lost to view after a few miles, being covered by some later formation, which in turn is covered by a still later one. Each formation thus appears as a terrace, bounded on one side by a descending cliff carved out of the edges of its own strata and on the other by an ascending cliff carved out of the strata which overlie it. This is the more common form, although isolated mesas, bits of tableland completely engirdled by cliffs, are but little less common.

The courses of the margins of the mesas are not regular. The cliffs sometimes maintain an average trend through great distances, but in detail their courses are extremely crooked; they wind in and out, forming alternate alcoves and promontories in the wall, and frequently they are cut through by valleys, which may be either narrow canyons or interspaces 10 or even 20 miles wide.

The whole region has been subjected to many displacements, both flexures of the monoclinal type and faults. Some of these flexures attain a length of over 80 miles and a displacement of 3,000 feet, and the faults reach even a greater magnitude. There is also an abundance of volcanic rocks and extinct volcanoes, and while the principal eruptions have occurred about the borders of the region, extending but slightly

[1] See Major C. E. Dutton's map of the plateau country in 6th Ann. Rept. U. S. Geol. Survey, pl. xi. His report on "Mount Taylor and the Zuñi plateau," of which this map is a part, presents a vivid picture of the plateau country, and his descriptions are so clear and expressive that any attempt to better them must result in failure. The statement of the geologic and topographic features which is incorporated herein is derived directly from Major Dutton's description, much of it being taken bodily.

into it, traces of lesser disturbances can be found throughout the country. It has been said that if a geologist should actually make the circuit of the plateau country, he could so conduct his route that for three-fourths of the time he would be treading upon volcanic materials and could pitch his camp upon them every night. The oldest eruptions do not go back of Tertiary time, while some are so recent as probably to come within the historic period—within three or four centuries.

The strata of the plateau country are remarkable for their homogeneity, when considered with reference to their horizontal extensions; hardly less so for their diversity when considered in their vertical relation. Although the groups differ radically from each other, still each preserves its characteristics with singularly slight degrees of variation from place to place. Hence we have a certain amount of similarity and monotony in the landscape which is aided rather than diminished by the vegetation; for the vegetation, like the human occupants of this country, has come under its overpowering influence. The characteristic landscape consists of a wide expanse of featureless plains, bounded by far-off cliffs in gorgeous colors; in the foreground a soil of bright yellow or ashy gray; over all the most brilliant sunlight, while the distant features are softened by a blue haze.

The most conspicuous formation of the whole region is a massive bright-red sandstone out of which have been carved "the most striking and typical features of those marvelous plateau landscapes which will be subjects of wonder and delight to all coming generations of men. The most superb canyons of the neighboring region, the Canyon de Chelly and the Del Muerto, the lofty pinnacles and towers of the San Juan country, the finest walls in the great upper chasms of the Colorado, are the vertical edges of this red sandstone."

Of the climate of the plateau country it has been said that in the large valleys it is "temperate in winter and insufferable in summer; higher up the summers are temperate and the winters barely sufferable." It is as though there were two distinct regions covering the same area, for there are marked differences throughout, except in topographic configuration, between the lowlands and the uplands or high plateaus. The lowlands present an appearance which is barren and desolate in the extreme, although the soil is fertile and under irrigation yields good crops. Vegetation is limited to a scanty growth of grass during a small part of the year, with small areas here and there scantily covered by the prickly greasewood and at intervals by clumps of sagebrush; but even these prefer a higher level, and develop better on the neighboring mesas than in the valleys proper. The arborescent growth consists of sparsely distributed cottonwoods and willows, closely confined to the river bottoms. On intermediate higher levels junipers and cedars appear, often standing so closely together as to seriously impede travel, but they are confined to the tops of mesas and

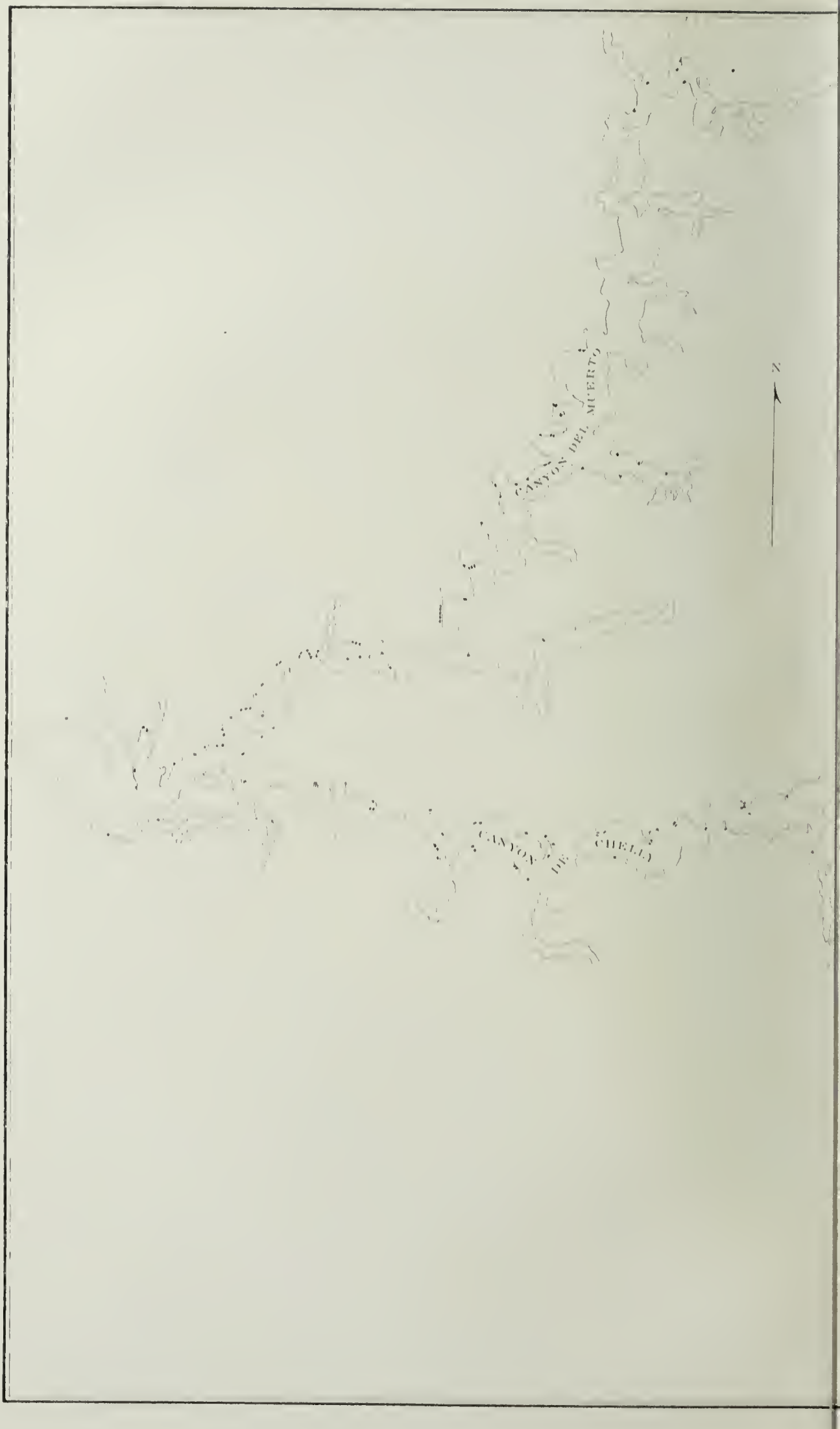
other high ground, the valleys being generally clear or covered with sagebrush. Still higher up yellow pines become abundant and in places spread out into magnificent forests, while in some mountain regions scrub oak, quaking asp, and even spruce trees are abundant.

In the mountain regions there is often a reasonable amount of moisture, and some crops, potatoes for example, are grown there without irrigation; but the season is short. In the Tunicha mountains the Navaho raise corn at an altitude of nearly 8,000 feet, but they often lose the crop from drought or from frost. On the intermediate levels and in the lowlands cultivation by modern methods is practically impossible without irrigation, except in a few favored localities, where a crop can be obtained perhaps two years or three years in five. But with a minute knowledge of the climatic conditions, and with methods adapted to meet these conditions, scanty crops can be and are raised by the Indians without irrigation throughout the whole region; but everywhere that water can be applied the product of the soil is increased many fold.

Near the center of the plateau country, in the northeastern corner of Arizona, a range of mountains crosses diagonally from northwest to southeast, extending into New Mexico. In the north an irregular cluster of considerable size, separated from the remainder of the range, is called the Carrizo; and the range proper has no less than three names applied to different parts of it. The northern end is known as the Lukachukai, the central part as the Tunicha, and the southern part as the Chuska or Choiskai mountains, all Navaho names. The two former clusters attain an altitude of 9,500 feet; the Tunicha and the Chuska are about 9,000 feet high, the latter having a flat top of considerable area.

On the east these mountains break down rather abruptly into the broad valley of the Chaco river, or the Chaco wash, as it is more commonly designated; on the west they break down gradually, through a series of slopes and mesas, into the Chin Lee valley. Canyon de Chelly has been cut in the western slope by a series of small streams, which, rising near the crest of the mountain, combine near its head and flow in a general westerly direction. The mouth of the canyon is on the eastern border of the Chin Lee valley. It is 60 miles south of the Utah boundary and 25 miles west of that of New Mexico; hence it is 60 miles east and a little north from the old province of Tusayan, the modern Moki, and 85 miles northwest from the old province of Cibola, the modern Zuñi. Its position is almost in the heart of the ancient pueblo region; the Chaco ruins lie about 80 miles east, and the ruins of the San Juan from 60 to 80 miles north and northeast.

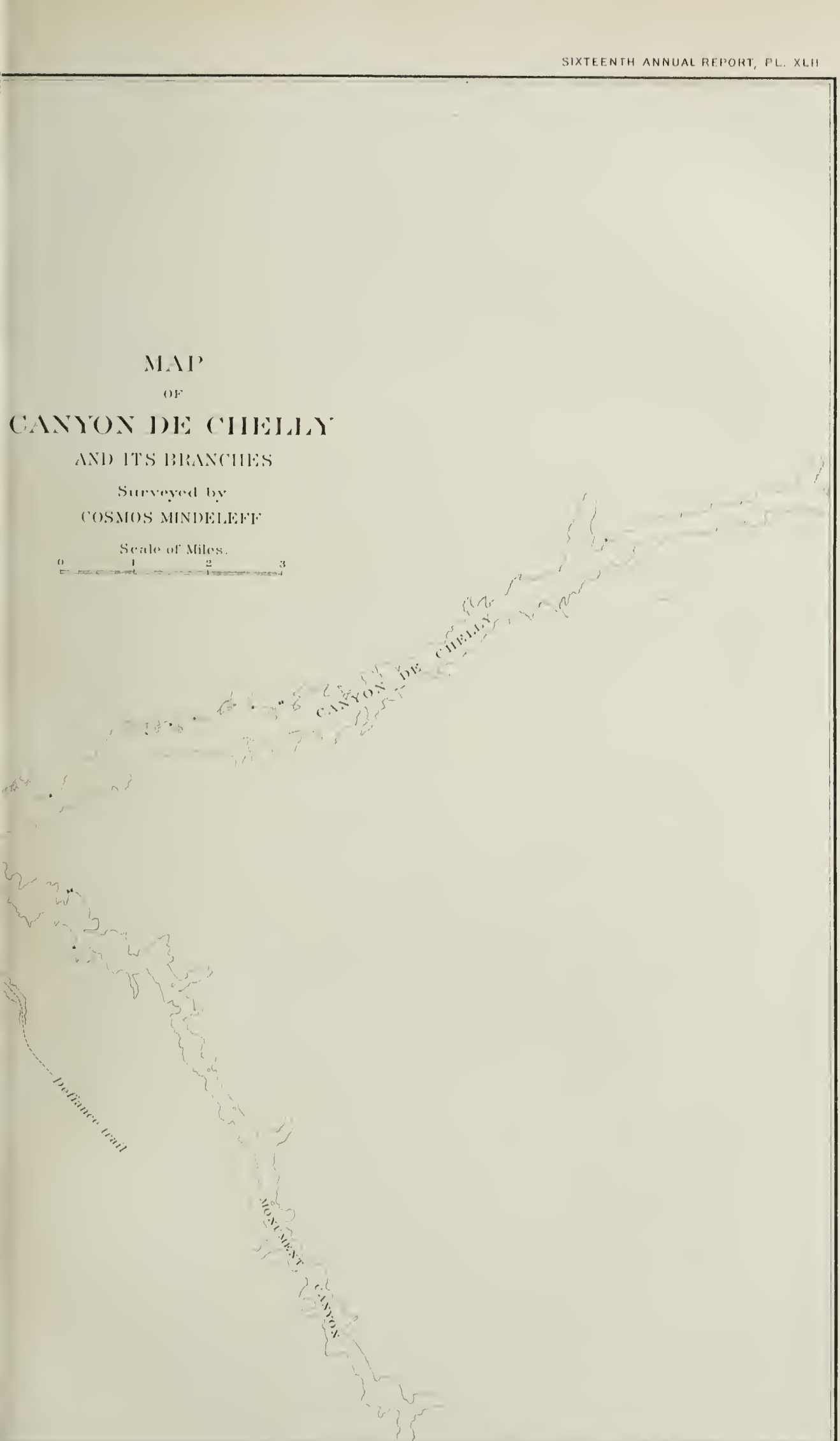
The geographic position of Canyon de Chelly has had an important effect on its history, forming as it does an available resting place in any migratory movement either on the north and south line or east and west. The Tunicha mountains are a serious obstacle to north and


CAÑON DEL MUERTO
N
CAÑON DE CHELLY

MAP
OF
CANYON DE CHELLY
AND ITS BRANCHES

Surveyed by
COSMOS MINDELEFF

Scale of Miles.
0 1 2 3



south movement at the present day, but less so than the arid valleys which border them. Except at one place, and that place is difficult, it is almost impossible to cross the mountains with a wheeled vehicle, but there are innumerable trails running in all directions, and these trails are in constant use by the Navaho, except in the depths of winter. The mountain route is preferable, however, to the valley roads, where the traveler for several days is without wood, with very little water and forage, and his movements are impeded by deep sand.

To the traveler on foot, or even on horseback, Canyon de Chelly is easily accessible from almost any direction. Good trails run northward to the San Juan and northeastward over the Tunicha mountains to the upper part of that river; Fort Defiance is but half a day's journey to the southeast; Tusayan and Zuñi are but three days distant to the traveler on foot; the Navaho often ride the distance in a day or a day and a half. The canyon is accessible to wagons, however, only at its mouth.

The main canyon, shown on the map (plate XLII) as Canyon de Chelly and known to the Navaho as Tsé-gi, is about 20 miles long. It heads near Washington pass, within a few miles of the crest of the mountain, and extends almost due west to the Chin Lee valley. The country descends by a regular slope from an altitude of about 7,500 feet at the foot of the main crest to about 5,200 feet in the Chin Lee valley, 25 miles west, and is so much cut up locally by ravines and washes that it is impassable to wagons, but it preserves throughout its mesa-like character.

About 3 miles from its mouth De Chelly is joined by another canyon almost as long, which, heading also in the Tunicha mountains, comes in from the northeast. It is over 15 miles long, and is called on the map Canyon del Muerto; the Navaho know it as Én-a-tsé-gi. About 13 miles above the mouth of the main canyon a small branch comes in from the southeast. It is about 10 miles long, and has been called Monument canyon, on account of the number of upright natural pinnacles of rock in it. In addition to those named there are innumerable small branches, ranging in size from deep coves to real canyons a mile or two long. Outside of De Chelly, and independent of it, there is a little canyon about 4 miles long, called Tse-on-i-tso-si by the Navaho. At one point near its head it approaches so near to De Chelly that but a few feet of rock separate them.

On the western side of the mountains there are a number of small perennial streams fed by springs on the upper slopes. Several of these meet in the upper part of De Chelly, others in Del Muerto, and in the upper parts of these canyons there is generally water. But, except at the time of the autumn and winter rains and in the spring when the mountain snows are melting, the streams are not powerful enough to carry the water to the mouth of the canyon. The flow is absorbed by the deep sand which forms the stream bed. Ordinarily it is difficult to procure enough water to drink less than 8 or 10 miles from the mouth

of De Chelly, but occasionally the whole stream bed, at places over a quarter of a mile wide, is occupied by a raging torrent impassable to man or beast. Such ebullitions, however, seldom last more than a few hours. Usually water can be obtained anywhere in the bottom by sinking a shallow well in the sand, and it is by this method that the Navaho, the present occupants of the canyon, obtain their supply.

The walls of the canyon are composed of brilliant red sandstone, discolored everywhere by long streaks of black and gray coming from above. At its mouth it is about 500 feet wide. Higher up the walls sometimes approach to 300 feet of each other, elsewhere broadening out to half a mile or more; but everywhere the wall line is tortuous and crooked in the extreme, and, while the general direction of De Chelly is east and west, the traveler on the trail which runs through it is as often headed north or south. Del Muerto is even more tortuous than De Chelly, and in places it is so narrow that one could almost throw a stone across it.

At its mouth the walls of Canyon de Chelly are but 20 to 30 feet high, descending vertically to a wide bed of loose white sand, and absolutely free from talus or débris. Three miles above Del Muerto comes in, but its mouth is so narrow it appears like an alcove and might easily be overlooked. Here the walls are over 200 feet high, but the rise is so gradual that it is impossible to appreciate its amount. At the point where Monument canyon comes in, 13 miles above the mouth of De Chelly, the walls reach a height of over 800 feet, about one-third of which consists of talus.

The rise in the height of the walls is so gradual that when the canyon is entered at its mouth the mental scale by which we estimate distances and magnitudes is lost and the wildest conjectures result. We fail at first to realize the stupendous scale on which the work was done, and when we do finally realize it we swing to the opposite side and exaggerate. At the junction of Monument canyon there is a beautiful rock pinnacle or needle standing out clear from the cliff and not more than 165 feet on the ground. It has been named, in conjunction with a somewhat similar pinnacle on the other side of the canyon, "The Captains," and its height has been variously estimated at from 1,200 to 2,500 feet. It is less than 800. A curious illustration of the effects of the scenery in connection with this pinnacle may not be amiss. The author of Western Wilds (Cincinnati, 1878) thus describes it:

> But the most remarkable and unaccountable feature of the locality is where the canyons meet. There stands out 100 feet from the point, entirely isolated, a vast leaning rock tower at least 1,200 feet high and not over 200 thick at the base, as if it had originally been the sharp termination of the cliff and been broken off and shoved farther out. It almost seems that one must be mistaken; that it must have some connection with the cliff, until one goes around it and finds it 100 feet or more from the former. It leans at an angle from the perpendicular of at least 15 degrees; and lying down at the base on the under side, by the best sighting I could make, it seemed to me that the opposite upper edge was directly over me—that is to say, mechanically speaking, its center of gravity barely falls with the base, and a heave of only a yard or two more would cause it to topple over. (Page 257.)

The dimensions have already been given. The pinnacle is perfectly plumb.

The rock of which the canyon walls are formed is a massive sandstone in which the lines of bedding are almost completely obliterated. It is rather soft in texture, and has been carved by atmospheric erosion into grotesque and sometimes beautiful forms. In places great blocks have fallen off, leaving smooth vertical surfaces, extending sometimes from the top nearly to the stream bed, 400 feet or more in height and as much in breadth. In the lower parts of the canyons the walls, sometimes of the character described, sometimes with the surfaces and angles smoothed by the flying sand, are generally vertical and often overhang, descending sheer to the canyon bottom without talus or intervening slopes of débris. The talus, where there is any, is slight and consists of massive sandstone of the same character as the walls, but much rounded by atmospheric erosion. The enlarged map (plate XLIII) shows something of this character.

Near its mouth the whole bottom of the canyon consists of an even stretch of white sand extending from cliff to cliff. A little higher up there are small areas of alluvium, or bottom land, in recesses and coves in the walls and generally only a foot or two above the stream bed. Still higher up these areas become more abundant and of greater extent, forming regular benches or terraces, generally well raised above the stream bed. At the Casa Blanca ruin, 7 miles up the canyon, the bench is 8 or 10 feet above the stream. Each little branch canyon and deep cove in the cliffs is fronted by a more or less extended area of this cultivable bottom land. Ten miles up the talus has become a prominent feature. It consists of broken rock, sand, and soil, generally overlying a slope of massive sandstone, such as has been described, and which occasionally crops out on the surface. With the development of the talus the area of bottom land dwindles, and the former encroaches more and more until a little above the junction of Monument canyon the bottom land is limited to narrow strips and small patches here and there.

These bottom lands are the cultivable areas of the canyon bottom, and their occurrence and distribution have dictated the location of the villages now in ruins. They are also the sites of all the Navaho settlements in the canyon. The Navaho hogans are generally placed directly on the bottoms; the ruins are always so located as to overlook them. Only a very small proportion of the available land is utilized by the Navaho, and not all of it was used by the old village builders. The Navaho sites, as a whole, are far superior to the village sites.

The horticultural conditions here, while essentially the same as those of the whole pueblo region, present some peculiar features. Except for a few modern examples there are no traces of irrigating works, and the Navaho work can not be regarded as a success. The village builders probably did not require irrigation for the successful cultivation of their crops, and under the ordinary Indian methods of planting and cultivation a failure to harvest a good crop was probably rare. After

the harvest season it is the practice of the Navaho to abandon the canyon for the winter, driving their flocks and carrying the season's produce to more open localities in the neighboring valleys. The canyon is not a desirable place of residence in the winter to a people who live in the saddle and have large flocks of sheep and goats, but there is no evidence that the old inhabitants followed the Navaho practice.

During most of the year there is no water in the lower 10 miles of the canyons, where most of the cultivable land is situated. The autumn rains in the mountains, which occur late in July or early in August, sometimes send down a little stream, which, however, generally lasts but a few days and fails to reach the mouth of the canyon. Late in October, or early in November, a small amount comes down and is fairly permanent through the winter and spring. The stream bed is even more tortuous than the canyon it occupies, often washing the cliffs on one side, then passing directly across the bottom and returning again to the same side, the stream bed being many times wider than the stream, which constantly shifts its channel. In December it becomes very cold and so much of the stream is in shade during a large part of the day that much of the water becomes frozen and, as it were, held in place. In the warm parts of the day, and in the sunshine, the ice is melted, the stream resumes its flow, and so gradually pushes its way farther and farther down the canyon. But some sections, less exposed to warmth than others, retain their ice during the day. These points are flooded by the water from above, which is again frozen during the night and again flooded the next day, and so on. In a short time great fields of smooth ice are formed, which render travel on horseback very difficult and even dangerous. This, and the scant grazing afforded by the bottom lands in winter, doubtless is the cause of the annual migration of the Navaho; but these conditions would not materially affect a people living in the canyon who did not possess or were but scantily supplied with horses and sheep. The stream when it is flowing is seldom more than a foot deep, generally only a few inches, except in times of flood, when it becomes a raging torrent, carrying everything before it. Hence irrigation would be impracticable, even if its principles were known, nor is it essential here to successful horticulture.

One of the characteristic features of the canyons at the present day is the immense number of peach trees within them. Wherever there is a favorable site, in some sheltered cove or little branch canyon, there is a clump of peach trees, in some instances perhaps as many as 1,000 in one "orchard." When the peaches ripen, hundreds and even thousands of Navaho flock to the place, coming from all over the reservation, like an immense flock of vultures, and with disastrous results to the food supply. A few months after it is difficult to procure even a handful of dried fruit. The peach trees are, of course, modern. They were introduced into this country originally by the Spanish monks, but in De Chelly there are not more than two or three

trees which are older than the last Navaho war. At that time, it is said, the soldiers cut down every peach tree they could find. But, aside from the peaches, De Chelly was until recently the great agricultural center of the Navaho tribe, and large quantities of corn, melons, pumpkins, beans, etc. were and are raised there every year. Under modern conditions many other localities now vie with it, and some surpass it in output of agricultural products, but not many years ago De Chelly was regarded as the place par excellence.

It will be clear, therefore, that prior to very recent times De Chelly would be selected by almost any tribe moving across the country, and, barring a hostile prior occupancy, would be the most desirable place for the pursuit of horticultural operations for many miles in any direction. The vicinity of the Tunicha mountains, which could be reached in half a day from any part of the canyons, and which must have abounded in game, for even now some is found there, would be a material advantage. The position of the canyon in the heart of the plateau country and of the ancient pueblo region would make it a natural stopping place during any migratory movement either north and south or east and west, and its settlement was doubtless due to this favorable position and to the natural advantages it offered. This settlement was effected probably not by one band or tribe, nor at one time, but by many bands at many times. Probably the first settlements were very old; certainly the last were very recent.

CLASSIFICATION AND DESCRIPTIONS

RUINS OF THE PUEBLO REGION

No satisfactory general classification of the ruins of the ancient pueblo region has yet been made; possibly because the material in hand is not sufficiently abundant. There are thousands of ruins scattered over the southwest, of many different types which merge more or less into each other. In 1884 Mr A. F. Bandelier, whose knowledge of the archeology of the southwest is very extensive, formulated a classification, and in 1892, in his final report,[1] he announces that he has nothing to change in it. The classification is as follows:

I. Large communal houses several stories high.
- (*a*) Composed of one or two, seldom three, extensive buildings, generally so disposed as to surround an interior court.
- (*b*) Polygonal pueblos.
- (*c*) Scattered pueblos, composed of a number of large many-storied houses, disposed in a more or less irregular manner; sometimes in irregular squares or on a line.
- (*d*) Artificial caves, resembling in number, size, and disposition of the cells the many-storied communal dwelling.
- (*e*) Many-storied dwellings, with artificial walls, erected inside of natural caves of great size.

II. Detached family dwellings, either isolated or in groups forming villages.

[1] Arch. Inst. of America, 5th Ann. Rept., p. 55; and Arch. Inst. of America, Papers, American series, IV, p. 27.

Many hundreds of ruins have been examined by Mr Bandelier, and doubtless the classification above afforded a convenient working basis for the region with which he is most familiar, the basin of the Rio Grande and its tributaries. It does not apply very well to the western part of the pueblo region.

The distinguishing characteristics of the first group (of five classes)—houses several stories high—are as follows: Each building consisted of an agglomeration of a great number of small cells, without any larger halls of particularly striking dimensions. All the buildings, except outhouses or additions, were at least two stories high, and the lower story was entered only from the roof. The various stories receded from the bottom to the top. The prevalence of the estufa (kiva) generally, or often, circular in form.

Ruins of class II—detached family dwellings—consist sometimes of a single room; more often of several rooms. The rooms are generally built of stone, although examples constructed of mud and adobe are also found in certain regions. The average size of the room is larger than in the communal building, and there is a gradual increase in size of rooms from north to south. There are front doorways and light and air holes are larger than in the communal houses. Mr Bandelier suggests that the detached family dwelling was the early type, and that only when enemies began to threaten were the communal houses resorted to for purposes of defense.

This classification is apparently based on external form alone, without taking into account the numerous influences which modify or produce form; and while no doubt it was sufficient for field use, it is not likely to be permanently adopted; for there does not appear to be any essential or radical difference between the various classes. Moreover, there does not appear to be any place in the scheme for the cliff ruins of the variety especially abundant in De Chelly and found in many other localities, unless indeed such ruins come under class II—detached family dwellings; yet this would imply precedence in time, and the ruins themselves will not permit such an inference.

The essential uniformity of types which prevails over the immense area covered by the ancient pueblo ruins is a noteworthy feature, and any system of classification which does not take it into account must be considered as only tentative. What elements should be considered and what weight assigned to each in preparing a scheme of classification is yet to be determined, but probably one of the most important elements is the character of the site occupied, with reference to its convenience and defensibility. There are great differences in kind between the great valley pueblos, located without reference to defense and depending for security on their size and the number of their population, of which Zuñi and Taos are examples, and the villages which are located on high mesas and projecting tongues of rock; in other words, on defensive sites where reliance for security was placed on the char-

acter of the site occupied, such as the Tusayan villages of today. Within each of these classes there are varieties, and there are also secondary types which pertain sometimes to one, sometimes to the other, and sometimes to both. Such are the cliff ruins, the cavate lodges, and the single house remains.

The unit of pueblo architecture is the single cell, and in its development the highest point reached is the aggregation of a great number of such cells into one or more clusters, either connected with or adjacent to each other. These cells were all the same, or essentially so; for while differentiation in use or function had been or was being developed at the time of the Spanish conquest, differentiation in form had not been reached. The kiva, of circular or rectangular shape, is a survival and not a development.

Large aggregations of many cells into one cluster are the latest development of pueblo architecture. They were immediately preceded by a type composed of a larger number of smaller villages, located on sites selected with reference to their ease of defense, and apparently the change from the latter to the former type was made at one step, without developing any intermediate forms. The differences between the largest examples of villages on defensive sites and the smallest appear to be only differences of size. Doubtless in the early days of pueblo architecture small settlements were the rule. Probably these settlements were located in the valleys, on sites most convenient for horticulture, each gens occupying its own village. Incursions by neighboring wild tribes, or by hostile neighbors, and constant annoyance and loss at their hands, gradually compelled the removal of these little villages to sites more easily defended, and also forced the aggregation of various related gentes into one group or village. At a still later period the same motive, considerably emphasized perhaps, compelled a further removal to even more difficult sites. The Tusayan villages at the time of the Spanish discovery were located on the foothills of the mesas, and many pueblo villages at that period occupied similar sites. Actuated by fear of the Ute and Comanche, and perhaps of the Spaniards, the inhabitants soon after moved to the top of the mesa, where they now are. Many villages stopped at this stage. Some were in this stage at the time of the discovery—Acoma, for example. Finally, whole villages whose inhabitants spoke the same language combined to form one larger village, which, depending now on size and numbers for defense, was again located on a site convenient for horticulture.

The process sketched above was by no means continuous. The population was in slow but practically constant movement, much the same as that now taking place in the Zuñi country; it was a slow migration. Outlying settlements were established at points convenient to cultivable fields, and probably were intended to be occupied only during the summer. Sometimes these temporary sites might be found more convenient than that of the parent village, and it would gradually come

about that some of the inhabitants would remain there all the year. Eventually the temporary settlement might outgrow the parent, and would in turn put out other temporary settlements. This process would be possible only during prolonged periods of peace, but it is known to have taken place in several regions. Necessarily hundreds of small settlements, ranging in size from one room to a great many, would be established, and as the population moved onward would be abandoned, without ever developing into regular villages occupied all the year. It is believed that many of the single house remains of Mr Bandelier's classification[1] belong to this type, as do also many cavate lodges, and in the present paper it will be shown that some at least of the cliff ruins belong to the same category.

The cliff ruins are a striking feature, and the ordinary traveler is apt to overlook the more important ruins which sometimes, if not generally, are associated with them. The study of the ruins in Canyon de Chelly has led to the conclusion that the cliff ruins there are generally subordinate structures, connected with and inhabited at the same time as a number of larger home villages located on the canyon bottom, and occupying much the same relation to the latter that Moen-kapi does to Oraibi, or that Nutria, Pescado, and Ojo Caliente do to Zuñi; and that they are the functional analogues of the "watch towers" of the San Juan and of Zuñi, and the brush shelters or "kisis" of Tusayan; in other words, they were horticultural outlooks occupied only during the farming season.

Mr G. Nordenskiöld, who examined a number of cliff and other ruins in the Mancos canyon and the Mesa Verde region, adopts[2] a very simple classification, as follows:

I. Ruins in the valleys, on the plains, or on the plateaus.
II. Ruins in caves in the walls of the canyons, subdivided as follows:
  (*a*) Cave dwellings, or caves inhabited without the erection of any buildings within them.
  (*b*) Cliff dwellings, or buildings erected in caves.

From its topographic character it might be expected that the Canyon de Chelly ruins would hardly come within a scheme of classification based upon those found in the open country; and here, if anywhere, we should find corroboration of the old idea that the cliff ruins were the homes and last refuge of a race harassed by powerful enemies and finally driven to the construction of dwellings in inaccessible cliffs, where a last ineffectual stand was made against their foes; or the more recent theory that they represent an early stage in the development of pueblo architecture, when the pueblo builders were few in number and surrounded by numerous enemies. Neither of these theories are in accord with the facts of observation. The still later idea that the cliff dwellings were used as places of refuge by various pueblo tribes who, when

[1] See a paper by the author on "Aboriginal remains in Verde valley, Arizona," in 13th Ann. Rept. Bureau of Ethnology, p. 179 et seq.

[2] The Cliff Dwellers of the Mesa Verde, pp. 9 and 114.

DETAILED MAP OF PART OF CANYON DE CHELLY SHOWING ARE

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OF CULTIVABLE LAND

the occasion for such use was passed, returned to their original homes, or to others constructed like them, may explain some of the cliff ruins, but if applicable at all to those of De Chelly, it applies only to a small number of them.

The ruins of De Chelly show unmistakably several periods of occupancy, extending over considerable time and each fairly complete. They fall easily into the classification previously suggested, and exhibit various types, but the earliest and the latest forms are not found. In the descriptions which follow the classification below has been employed:

I—Old villages on open sites.
II—Home villages on bottom lands.
III—Home villages located for defense.
IV—Cliff outlooks or farming shelters.

I—OLD VILLAGES ON OPEN SITES

In the upper part of the canyon, and extending into what we may call the middle region, there are a number of ruins that seem to be out of place in this locality. They are exactly similar to hundreds of ruins found in the open country; such, for example, as the older villages of Tusayan, located on low foothills at the foot of the mesa, and the peculiar topographic characteristics of the location have not made the slightest impression on them. These ruins are located on gentle slopes, the foothills of the talus, as it were, away from the cliffs, and are now marked only by scattered fragments of building stone and broken pottery. The ground plans are in all cases indistinguishable; in only a few instances can even a short wall line be traced. They seem to have been located without special reference to large areas of cultivable land, although they always command small areas of such land. There is a remarkable uniformity in ruins of this type in character of site occupied, outlook, and general appearance. They are always close to the stream bed, seldom more than 10 or 12 feet above it, and the sites were chosen apparently without any reference to their defensibility. A typical example occurs at the point marked 60 on the detailed map (plate XLIII), another occurs at 58, and another at 52. One of the largest examples is in the lower part of the canyon. At the junction of Del Muerto there is a large mass of rock standing out alone and extending nearly to the full height of the canyon walls. On the south it is connected with the main wall back of it by a low tongue of rock, sparsely covered in places by soil and sand, and on the top of this tongue or saddle there is a large ruin of the type described, but no ground plan can now be made out. Possibly the obliterated appearance of this ruin and of others of the same class is due to the use of the material, ready to hand and of the proper size, in later structures. It is known that a similar appearance was produced in Tusayan by such a cause. The old village of Walpi, on a foothill below the mesa point and the site of the village at the time of the Spanish conquest, presents an appearance of great antiquity, although it was partly occupied so late as fifty

years ago. When the movement to the summit of the mesa became general, the material of the old houses was utilized in the construction of the new ones, and at the present day it can almost be said that not one stone remains above another. So complete is the obliteration that no ground plan can be made out.

If similar conditions prevailed in De Chelly, there might be many more ruins of this class than those so far discovered. Even those found are not easily distinguished and might easily be passed over. Possibly there were small ruins of this type scattered over the whole canyon bottom. An example which occurs at the point marked 12 on the map, and shown in plate XLIV, presents no trace on the surface except some potsherds, which in this locality mean nothing. The site is a low hill or end of a slope, the top of which is perhaps 25 feet above the stream bed, but separated from it by a belt of recent alluvium carpeted with grass. The hill itself was formed of talus, covered with alluvium, all but a small portion of which was subsequently cut away, leaving an almost vertical face 15 or 18 feet high. In this face the ends or vertical sections of several walls can be seen; one of them is nearly 3 feet thick and extends 4 feet below the present ground surface.

The filling of these ruins to a depth of 4 or 5 feet and the almost complete absence of surface remains or indications does not necessarily imply a remote antiquity, although it suggests it. During the fall and early winter months tremendous sand storms rage in the canyon; the wind sweeps through the gorge with an almost irresistible power, carrying with it such immense quantities of sand that objects a few hundred feet distant can not be distinguished. These sand storms were and are potent factors in producing the picturesque features of the red cliffs forming the canyon walls; but they are constructive as well as destructive, and cavities and hollow places in exposed situations such as the canyon bottom are soon filled up. The stream itself is also a powerful agent of destruction and construction; during flood periods banks of sand and alluvium are often cut away and sometimes others are formed. Yet there are reasons for believing that the old village ruins on open sites, now almost obliterated, mark the first period in the occupancy of the canyon, perhaps even a period distinctly separated from the others. Excavation on these sites would probably yield valuable results.

II—HOME VILLAGES ON BOTTOM LANDS

Ruins comprised in the second class are located on the bottom lands, generally at the base of a cliff, and without reference to the defensibility of the site. They are, as a rule, much broken down, and might perhaps be classed with the ruins already described, but there are some distinctive features which justify us in separating them. Ruins of this class are always located either at the base of a cliff or in a cove under it, on the level or raised but slightly above the bottom land, and sometimes at a considerable distance from the stream. The ground plans

SECTION OF OLD WALLS, CANYON DE CHELLY

can generally be distinguished, and in many instances walls are still standing—sometimes to a height of three stories. The ground plans reflect more or less the charaeter of the site they occupy, and we would be as much surprised to find plans of their character in the open country as we are to see plans of class I within the canyon. Unlike the ground plans of elass I, those of this group were laid ont with direct reference to the cliff behind them, and which formed, as it were, a part of them.

In point of size, long period of occupancy, and position these villages were the most important in the eanyon. The ruins often cover considerable areas and almost invariably show the remains of one or more circular kivas. Sometimes they are located directly upon the bottom land, more often they occupy low swells next the cliff, rising perhaps 10 feet above the general level and affording a fine view over it. Sometimes they are found in alcoves at the base of the cliff, but they always rest on the bottom land whieh extends into them; these merge insensibly into the next class—village ruins on defensible sites—and the distinction between them is partly an arbitrary one, as is also that between the last mentioned and the eliff ruins proper.

Figure 1 is a ground plan of a small ruin located in Del Muerto, on the bottom lands near its month. No standing walls now remain,

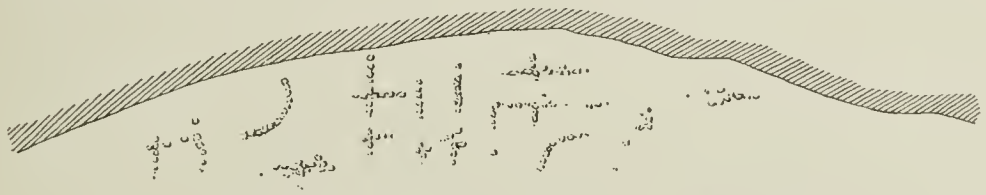


FIG. 1—Ground plan of an old ruin in Canyon del Muerto.

but there is no doubt that the village at one time covered much more ground than that shown on the plan. There are now remains of sixteen rooms on the ground, in addition to two kivas. There is a shallow alcove in the eliff at the ground level, and the overhanging cliff gave the village some protection overhead. Plate XLV shows another example in Del Muerto, the largest in that canyon. The walls are still standing to a height of three stories in one plaee, and the masonry is of high class. The back cliff has not entered into the plan here to the same extent that it generally does. Figure 2, a ground plan, exhibits only that portion of the area of the ruin on which walls are still standing. It shows abont 20 rooms on the ground, exclusive of three or perhaps four kivas. The rooms are small as a rule, rectangular, and arranged with a more than ordinary degree of regularity. One room still carries its roof intact, as shown on the plan. In the center of the ruin are the remains of a very large kiva, over 36 feet in diameter. It is now so mueh broken down that but little ean be inferred as to its former condition, exeept that there was probably no interior bench, as no remains of snch a structure can now be distinguished. The size of

this kiva is exceptional, and it is very probable that it was never roofed. The structures within the kiva, shown on the ground plan, are Navaho burial cists. West of the large kiva there were two others, less than 20 feet in diameter. One of these was circular; the other was irregular in shape, perhaps more nearly approaching an oval form.

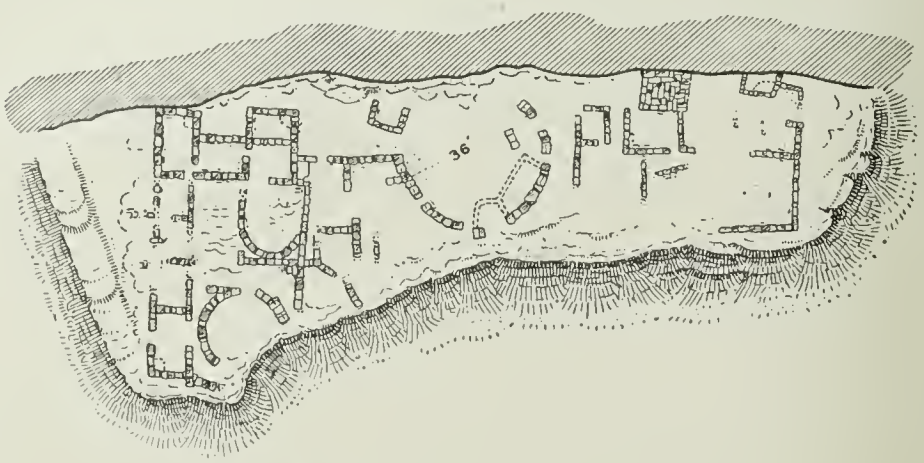


FIG. 2—Ground plan of a ruin on bottom land in Canyon del Muerto.

At no fewer than five places within the ruin there are comparatively recent Navaho burials.

Figure 3 is a ground plan of a small and very compact village, situated on the south side of the canyon at the point marked 28 on the detailed map. It is located on a slightly raised part of the bottom,

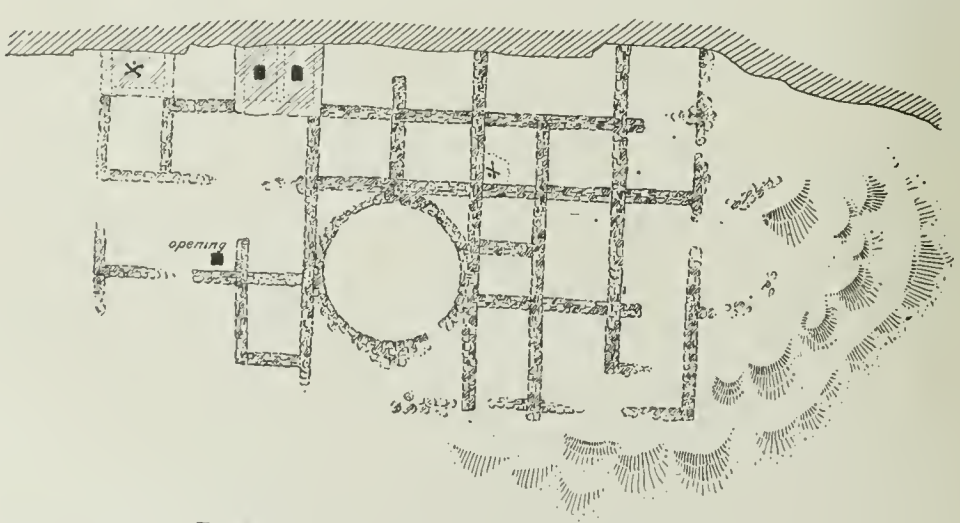
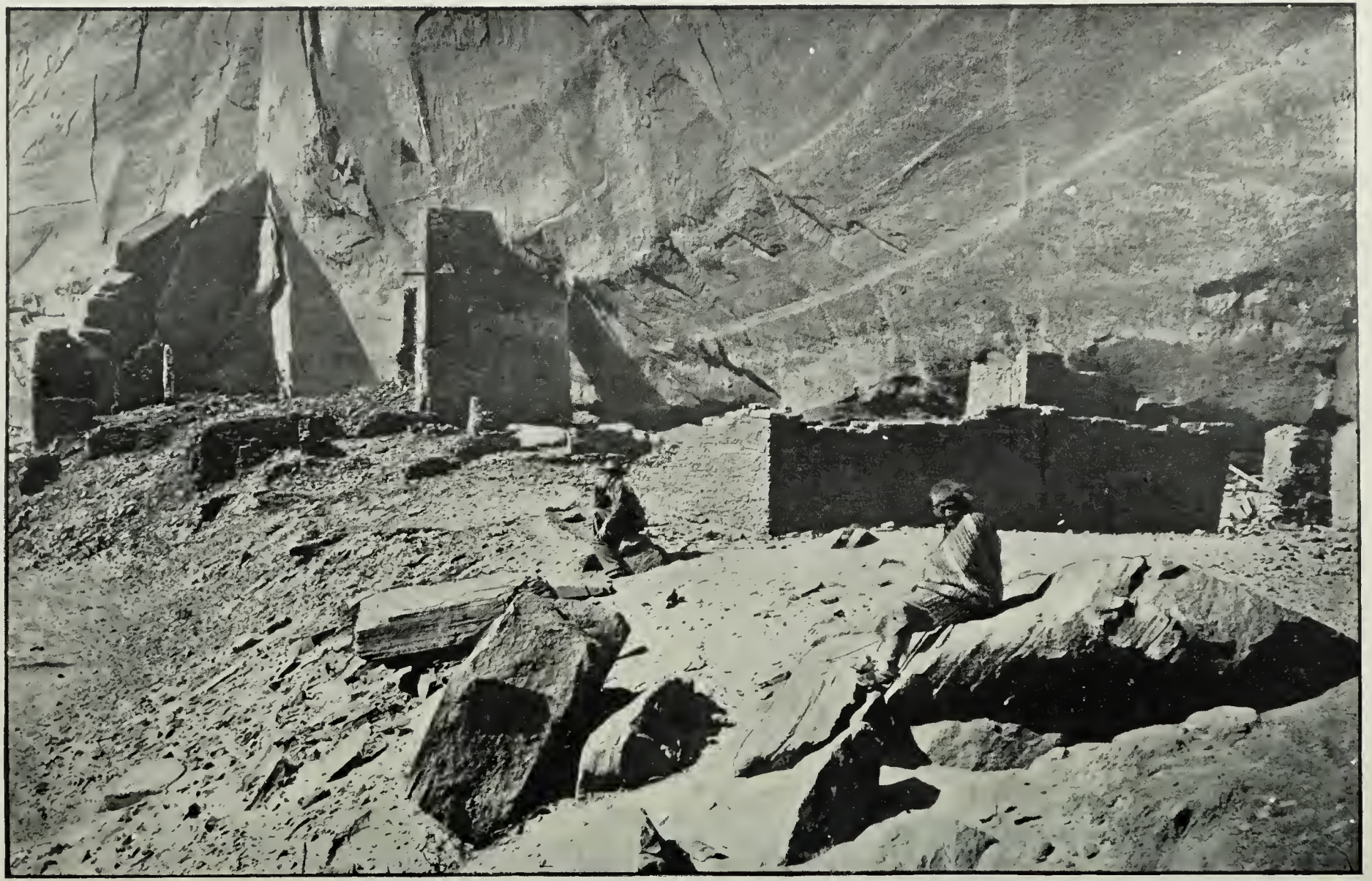


FIG. 3—Ground plan of a small ruin in Canyon de Chelly.

commanding an outlook over a large area now under cultivation by the Navaho. The wall lines are remarkably, although not perfectly, regular, and show at least 25 rooms; there were probably others to the northward and eastward. The rooms are now almost filled with débris, but two of them are still intact, being kept in order by the Navaho



GENERAL VIEW OF RUIN ON BOTTOM LAND, CANYON DEL MUERTO

and used for the storage of corn. The roofs of both these rooms are now on the ground level. The covered room nearest the cliff, shown on the plan, has been divided into two small compartments by a wall through the middle; access to each of these is obtained by a framed trapdoor in the roof about a foot square. This dividing wall is probably of Navaho origin, as the separate rooms formed by it are too small for habitation and the masonry is very rough. A short distance to the north along the cliff there is a Navaho house, roughly rectangular in plan, which was constructed of stone obtained from this site. The masonry of the ruin presents a very good face, not due to chinking, however, which was but slightly practiced, but to the careful selection of material. Some of the stones show surface peeking.

About 300 feet above or southeast of this ruin there are the remains of two small rooms which were placed against the cliff. They are of the same general character as those described, and doubtless formed part of the same settlement. Between the two occurs a curious feature. A large slab of rock, 280 feet long and not more than 12 feet thick at any point, has split off from the cliff and dropped down to the ground, where it remains on edge. This slab is triangular in elevation and about 50 feet high at the apex. Between it and the cliff, in the upper

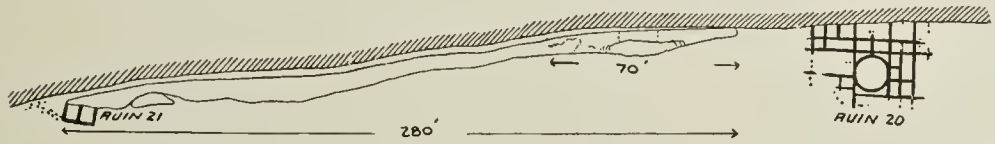


FIG. 4—Granary in the rocks, connected with a ruin.

part, there is a space from 2 to 2½ feet wide. This is easily accessible from the north, on the edge of the slab, and can be reached from the southern end, but with much difficulty. Figure 4 shows this feature and its relation to the ruin. There is no doubt that this was a granary or huge storage bin, and probably the two rooms on the south were placed there to guard that end; the northern end, of more easy access, being protected by the village itself. It was well adapted to this purpose—a fact that the Navaho have not been slow to appreciate. They have constructed small bins near the northern end, shown on the plan, and beyond this timbers have been wedged in so as to furnish a means of closing the cleft. In the cleft itself cross walls have been constructed, dividing it into several compartments. The interior forms a convenient dry, airy space, and at the time it was visited the floor was covered with a litter of cornhusks.

Almost directly opposite this ruin, on the other side of the canyon, are the remains of a village that might properly be called a cave village. At this point a large rock stands out from the cliff and in it there is a cavity shaped almost like a quarter sphere. Its greatest diameter is 45 feet and its height about 20 feet. The bottom land here is 10 or 12 feet above the stream bed and slopes up gradually toward

the cliff, forming the bottom of the cave, which is perhaps 18 or 20 feet above the stream and some distance from it. The cave commands an extensive outlook over the cultivable lands below it and those extending up a branch canyon a little above.

The whole bottom of the cave is covered by remains of rooms, shown in plan in figure 5. The population could not have been greater than 10 or 12 persons, yet the remains of two kivas are clearly shown. Both were in the front of the cave, adjoining but not connected with each other, and were about 12 feet in diameter. Both had interior benches, extending in one perhaps completely around, in the other only partly around. The rooms are very irregular in shape and in size, ranging from 8 by 10 feet to 3 by 4 feet, but the latter could be used only for storage. The masonry is not of fine grade, although good; but not much detail can be made out, as the place has been used as a

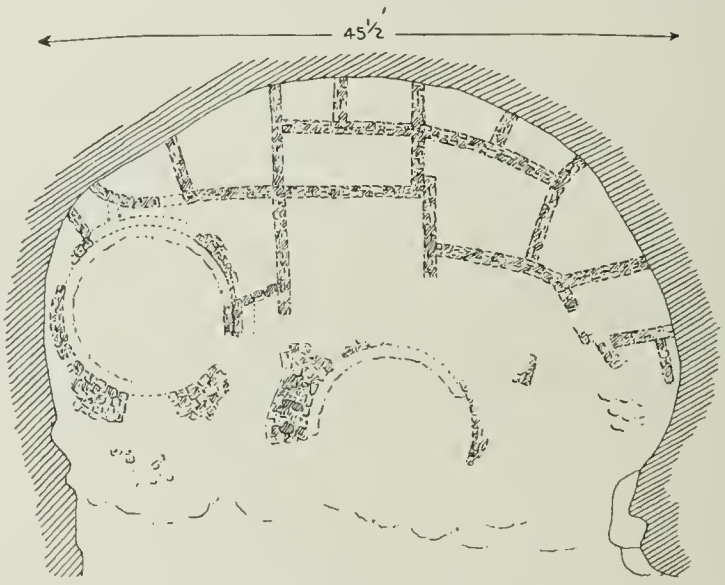


FIG. 5—Ground plan of a ruin in a cave.

sheepfold by the Navaho and the ground surface has been filled up and smoothed over.

The largest ruin in the canyons is that shown in plan in figure 6. It is situated in Del Muerto, on the canyon bottom at the base of a cliff, and is known to the Navaho as Pakashi-izini (the blue cow). The name was derived probably from a pictograph of a cow done in blue paint on the canyon wall back of the ruin. Traces of walls extend over a narrow belt against the cliffs about 400 feet long and not over 40 feet wide, and over this area many walls are still standing. Scattered over the site are a number of large bowlders. No attempt to remove these was made, but walls were carried over and under them, and in some cases the direction of a wall was modified to correspond with a face of a bowlder.

The settlement may have consisted of two separate portions, divided by a row or cluster of large bowlders. The group shown on the right

of the plan was very compactly built, in one place being four rooms deep, but no traces of a kiva can be seen in it, nor does there appear to be any place where a kiva could be built within the house area or immediately adjacent to it. At present 14 or 15 rooms may be traced on the ground and the whole structure may have comprised 30 rooms. The wall lines are not regular. In the western end of the structure there is a narrow passageway into a large room in the center. Such passageways, while often seen in the valley pueblos, are rare in these canyons. The three rooms to the south of the passageway appear to have been added after the rest of the structure was completed, and diminished in size regularly by a series of steps or insets in the northern or passage wall.

The other portion of the ruin shows the remains of about 40 rooms on the ground, in addition to three kivas; there may have been 60 rooms in this part of the settlement, or 85 or 90 rooms altogether. The population could not have been over 55 or 60 persons, or about 12 families. In other words, it appears that, owing to the peculiarities of conditions under which they lived, and of the ground plan which resulted, the largest settlement of this class in the canyons, extending over 400 feet in one direction, provided homes for a very limited number of people. As it is probable that each family had one or more outlooks, occupied in connection with their horticultural operations, it will readily be seen that only a small number of inhabitants might leave a large number of house remains, and that it is not necessary to assume either a large population or a long period of occupancy.

The kivas are clustered in the lower end of the settlement, and all appear to have been inclosed within walls or other buildings. Two of them are fairly well preserved; of the third only a fragment

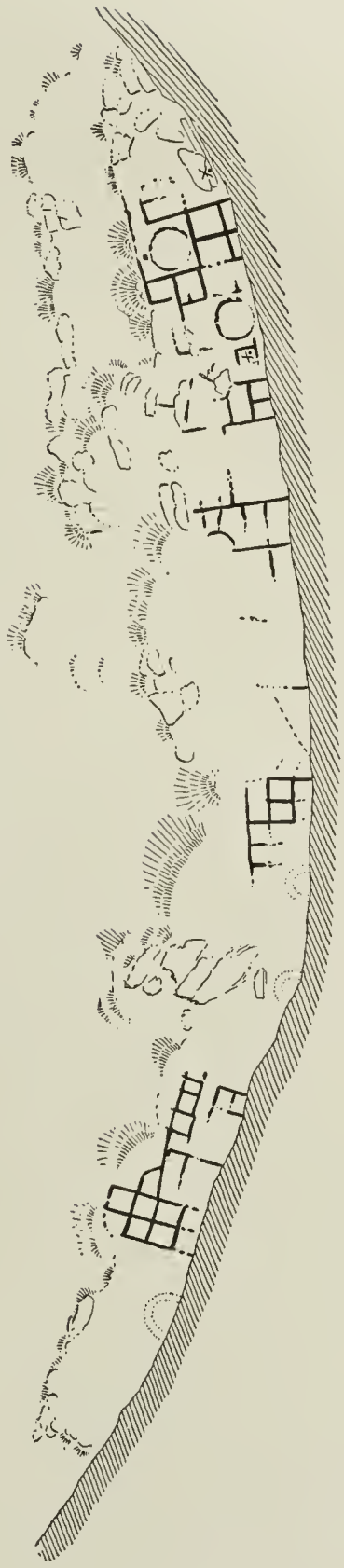


FIG. 6—Ground plan of Pakashi-izini ruin, Canyon del Muerto.

remains. The inclosure of the kivas is a suggestive feature, which will be discussed later, as will also the square shaft shown on the plan as attached to the principal kiva.

It will be noticed that in several places where bowlders occur within the limits of the settlement they have been incorporated into the walls and form part of them. In two places they have altered the direction of walls and produced irregularities in the plan. Elsewhere the face

FIG. 7—Ground plan of a ruin in Canyon del Muerto.

of a rock has been prolonged by a wall carried out to continue it, as in the front wall of the principal kiva apartment. This apartment appears to have been entered from the west through a passageway. This is an anomalous feature and suggests modernness.

Figure 7 is a ground plan of another ruin in Del Muerto. There is a slight cove or bay in the cliff at the point where the ruin occurs, and the ground, which is on the level of the bottom lands, is strewn

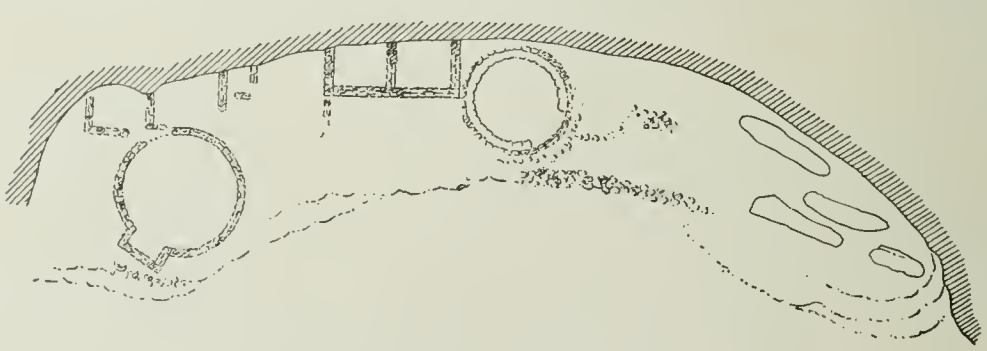


FIG. 8—Ground plan of a ruin in Tseonitsosi canyon.

with large bowlders, as in the example last described. But few remains of walls are now observable, and there are traces of only one kiva. This was situated near the outer edge of the settlement. The wall lines are irregular and the disposition and size of the bowlders are such that it is improbable that this site was ever occupied by a large cluster of rooms. On the left of the plan will be seen a small room or storage cist still intact. At the point marked > in the center

of the site a burial cist was found and excavated in 1884 by Mr Thomas V. Keam. It contained the remains of a child, almost perfectly desiccated. It is said that when the remains were first removed the color of the iris could be distinguished. The specimen was subsequently deposited in the National Museum.

A ruin which occurs in Tse-on-i-tso-si canyon, near the mouth of De Chelly, is shown in plan in figure 8. There were two kivas, one of which was benched. The number of rooms connected with them is remarkably small—there could not have been more than six, if there were that many—and the character of the site is such as to preclude

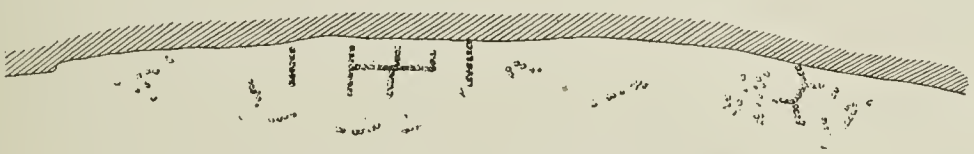


FIG. 9—Ground plan of a much obliterated ruin.

the possibility of other rooms in the immediate vicinity. Some of the walls are still standing, and exhibit a fair degree of skill in masonry.

A type of which there are many examples is shown in plan in figure 9. These ruins occur on the flat, next the cliff, which is seldom bayed and overhangs but slightly. They are usually so much obliterated that only careful scrutiny reveals the presence of wall lines, and walls standing to a height of 6 inches above the ground are rare. In the example illustrated no traces of a kiva can be found, but the almost complete destruction of the walls might account for this. There is every reason to suppose that these ruins are of the same class as those

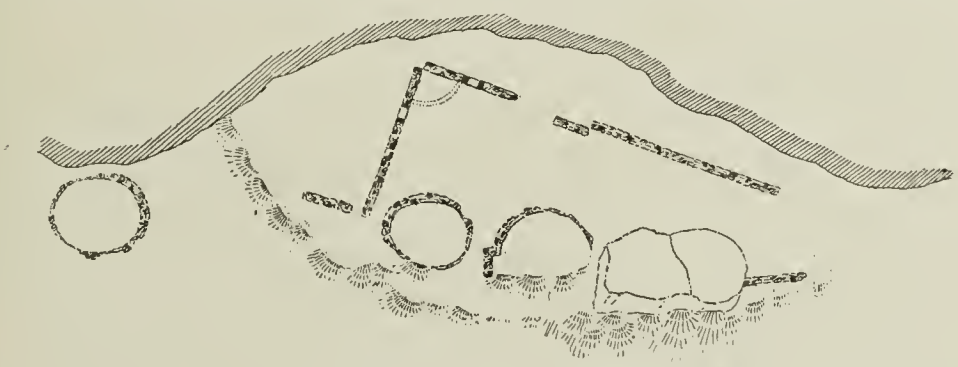


FIG. 10—Ground plan of a ruin in Canyon de Chelly.

described above, the remains of home villages located without reference to defense, and no reason to suppose otherwise. They are probably instances where, owing to exposed situation, early abandonment, and possibly also proximity to later establishments, destruction has proceeded at a greater rate than in other examples.

Ruins of the class under discussion were not confined to any part of the canyons, but were located wherever the conditions were favorable. An example which occurs in the lower part of the canyon, at the point marked 3 on the map, is shown in plan in figure 10. It occurs at the back of a deep cove in a little branch canyon, and was at one time

quite an extensive village. It was located on a slight slope or raised place next the cliffs and overhung by them. A stone dropped from the top of the cliffs would fall 45 or 50 feet out from their base. There are remains of three kivas. The central one, which was 12 feet in diameter, still shows nearly all its periphery, and the wall is in one place 3 feet high. The western kiva is now almost obliterated, but it can still be made out, and shows a diameter of 15 feet. It is 50 feet west of the central kiva and on a level about 8 feet below it, being only about 3 feet above the bottom land. East of the central kiva, and between it and a large bowlder, there was another, of which only a part now remains.

North of the central kiva, and extending nearly to the cliff behind, there are remains of rooms. One corner is still standing to a height of 3 to 4 feet. The western wall was smoothly plastered outside and was pierced by a narrow notched doorway. The northern wall has an opening still intact, shown in plate LVIII; it is 2 feet high and 14 inches wide, with a lintel composed of six small sticks about an inch in diameter, laid side by side. The sticks are surmounted by a flat stone, very roughly shaped and separated from them by an inch of mud plaster or mortar. The masonry is exceptionally well executed, that of the northern wall being composed of large stones carefully chinked and rubbed down. The chinking appears to have been carried through in bands, producing a decorative effect, resembling some of the masonry of the Chaco ruins. The western wall is composed of larger stones laid up more roughly with less chinking, and appears to have been a later addition. On the back wall of the cave are marks of walls showing a number of additional rooms, and there is no doubt that at one time there was quite an extensive settlement here.

Around the corner from the last example, as it were (at the point marked 4 on the map), and at the mouth of a little canyon that opens out from the head of the cove, the ruin shown in plate XLVI occurs. The village was located on the canyon bottom, in a shallow cove hardly 25 feet deep, but the view over the bottom is almost closed by a large sand dune, bare on top and but scantily covered on the sides with grass and weeds. Were it not for this dune, the site of the ruin would command one of the best areas of cultivable land in the canyon, but apparently an extensive outlook was not a desideratum. The slight elevation of the site above the level of the bottom lands is shown in the illustration.

The village was not a large one, having been occupied probably by only two families, yet there are traces of two kivas. That on the west is so far obliterated that its outline can be made out only with difficulty. That on the east still shows a part of its wall to a height of about a foot. The plan, figure 11, shows the general arrangement. Some of the walls are still standing to a height of 2 or 3 feet, and at the eastern end of the ruin there is a room with walls 6 feet high. More than the usual amount of mud mortar was used in the construction of

VILLAGE RUIN IN CANYON DE CHELLY

the walls of this room, and the interstices were filled with this, chinking with small stones being but slightly practiced. The masonry of the other walls is rougher, with even less chinking, and some of them show later additions which did not follow the main lines. The eastern room had two openings and the tops of the walls are apparently finished, for there are no marks of roof timbers. The room may have been roofless, but the same effect might have been produced by recent Navaho repairs and alterations. In the exterior wall, at the southeastern corner, there

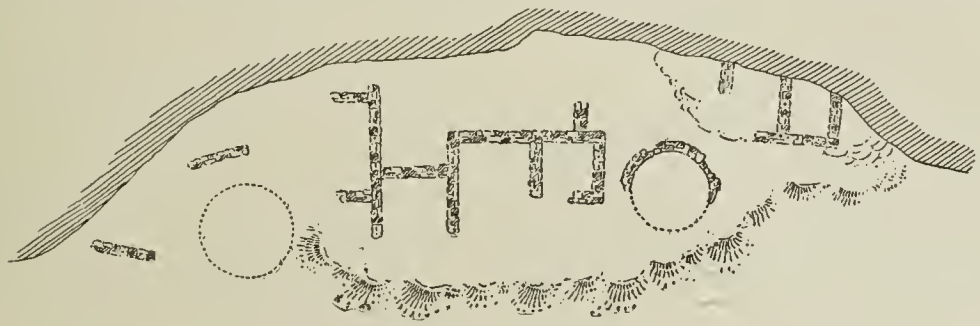


FIG. 11—Ground plan of a village ruin.

is a series of hand-holes, as though access to the interior were sometimes had in this way, but the hand-holes are later than the wall. On the back wall of the cove there are a number of pictographs.

Just above the mouth of Del Muerto and on the opposite side of the main canyon, at the point marked 17 on the map, there was a village on the canyon bottom. It overlooked a fine stretch of cultivable land on both sides of the canyon. There is a large isolated mass of rock here, nearly as high as the cliffs on either side, and connected with

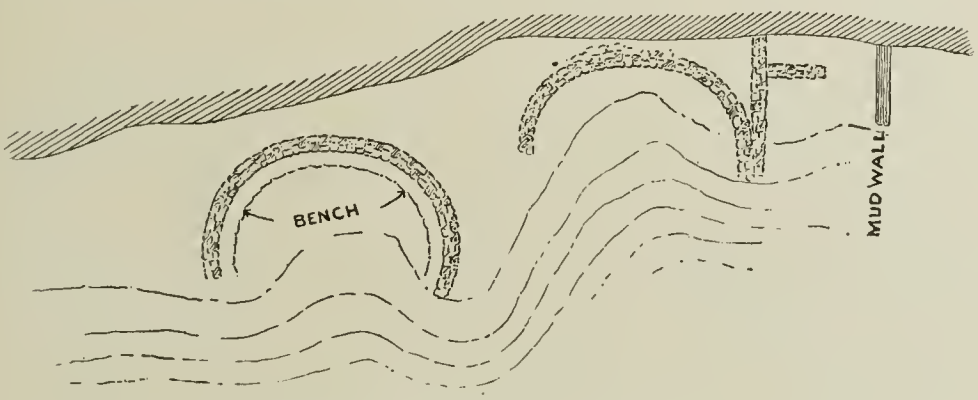


FIG. 12—Ground plan of kivas in Canyon de Chelly.

those back of it by a slope of talus and débris, partly bare rock, partly covered with sand dunes. At the point where the ruin occurs the rock is bare and about 40 feet high, partly overhanging the site. The remains, shown in plan in figure 12, occupy the summit of a hill about 10 feet high, composed principally of débris of walls. Only a few faint traces now remain, but two kivas are still clearly distinguishable. The one on the south had an interior bench, which apparently extended

around it. The other shows walls 2 feet high, and has been plastered with a number of successive coats. The small wall on the extreme right of the plan is composed of almost pure mud.

There are a number of ruins in the canyons of the type shown in figure 13. They are generally located directly on the bottom, and seldom as much as 5 feet above it, within coves or under overhanging cliffs; they are always of small area, and generally so far obliterated that no walls or wall remains are now visible. The obliteration is due not so much to antiquity, which may or may not have been a cause, but to the character of the site they occupied. They are always in sheltered situations, and being on the canyon bottom are much used by the Navaho as sheepfolds and have been so used for years. Sometimes, although rarely, faint traces of kivas can be made out.

The example illustrated occurs at the point marked 43 on the map. It is situated in a cove in a point of rock jutting out from the main cliff. The rock is about 60 feet high and the cove about 30 feet deep, and the remains are but a few feet above the level of the bottom land outside.

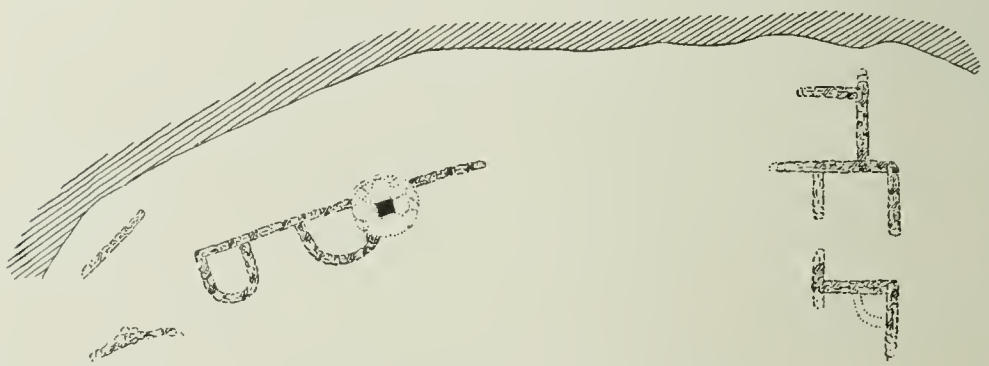
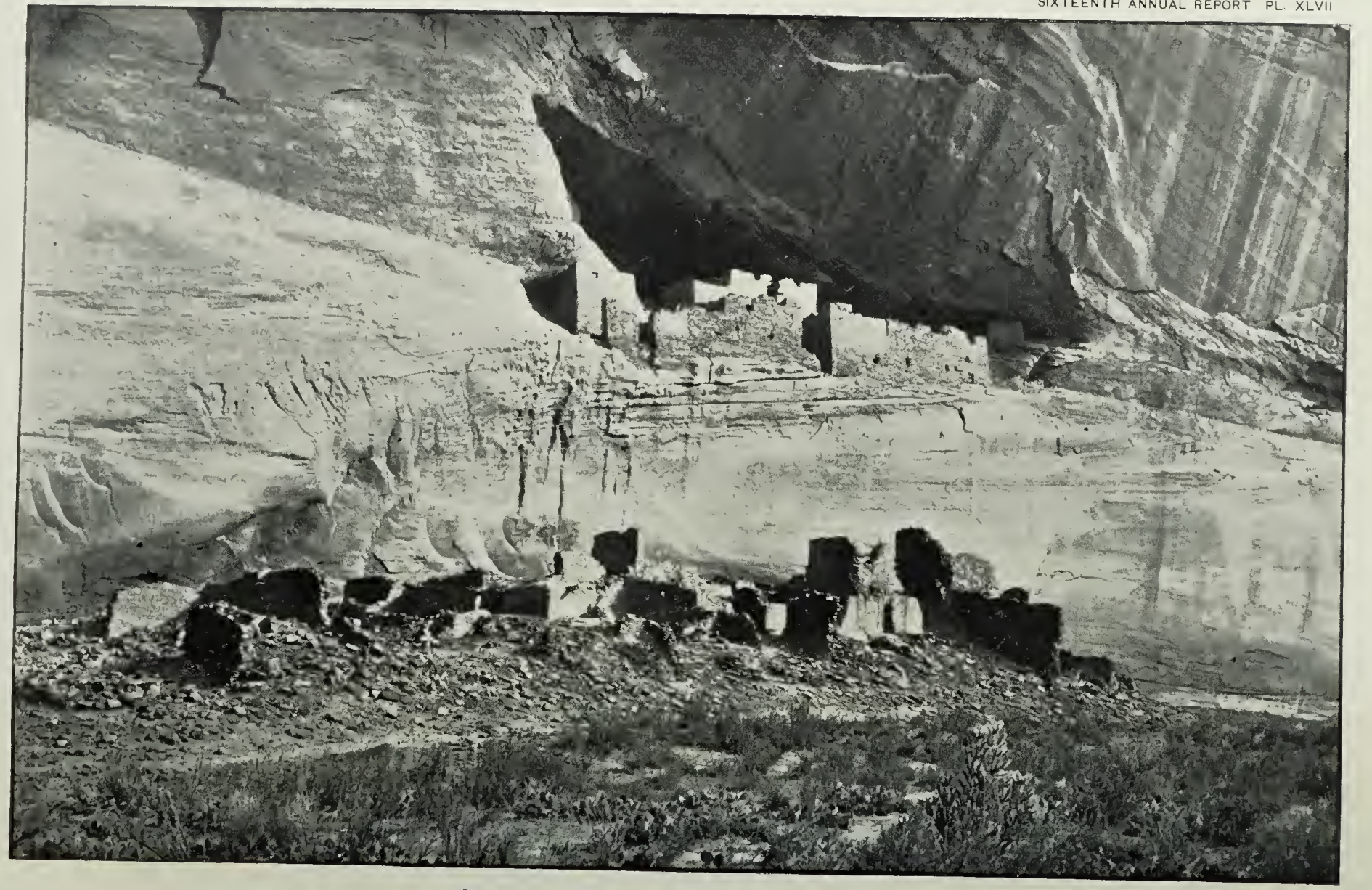


FIG. 13—Ground plan of a small ruin on bottom land.

The walls are composed of rather small stones; the interstices were chinked with spawls, and the masonry was laid up with an abundance of mud mortar. The back wall of the cove is considerably blackened by smoke.

One of the most striking and most important ruins in the canyon is shown in plan in figures 14 and 15. This is the ruin seen by Lieutenant Simpson in 1849 and subsequently called Casa Blanca. It is also known under the equivalent Navaho term, Kini-na e-kai or White House. The general character of the ruin is shown in plate XLVII, which is from a photograph. At first sight this ruin appears not to belong to this class, or rather to belong both to this class and the succeeding one composed of villages located with reference to defense; but, as will appear later, it has nothing in common with the latter.

In its present condition the ruin consists of two distinct parts—a lower part, comprising a large cluster of rooms on the bottom land against the vertical cliff, and an upper part which was much smaller and occupied a cave directly over the lower portion and was separated



CASA BLANCA RUIN, CANYON DE CHELLY

from it only by some 35 feet of vertical cliff. There is evidence, however, that some of the houses in the lower settlement were four stories high against the cliff, and in fact that the structures were practically continuous; but for convenience of description we may regard the ruin as composed of two.

The lower ruin covers an area of about 150 by 50 feet, raised but a few feet above the bottom land, probably by its own débris. Within this area there are remains of 45 rooms on the ground, in addition to a circular kiva. On the east side there are walls still standing to a height of 12 and 14 feet. It is probable that the lower ruin comprised about 60 rooms, which, with a liberal allowance for the rooms in the cave, would make a total of 80. This would furnish accommodations for a maximum of 10 or 12 families or a total population of 50 or 60 persons. It is probable, however, that this estimate is excessive and that the total population at any one time did not exceed 30 or 40 persons.

The ground plans shown are the result of a very careful survey, plotted on the ground on a large scale (10 feet to 1 inch—1:120), and the irregularities shown were carefully noted and put down at the time. These irregularities, which are commonly ignored in the preparation

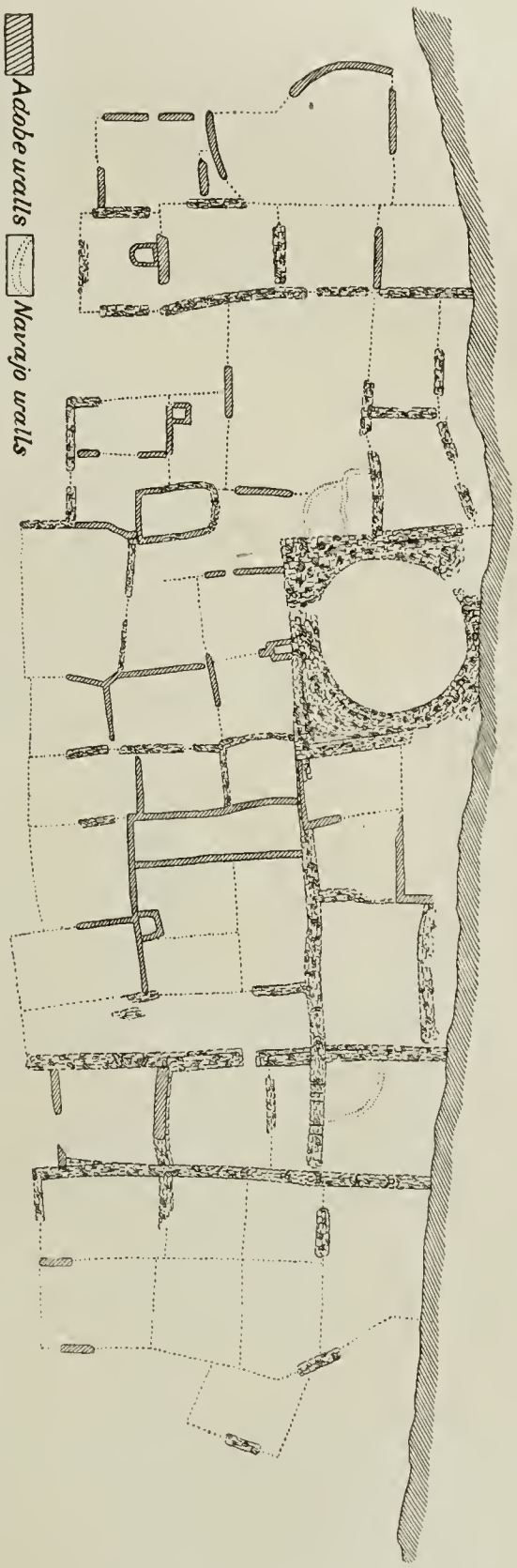


FIG. 14—Ground plan of the lower part of Casa Blanca ruin.

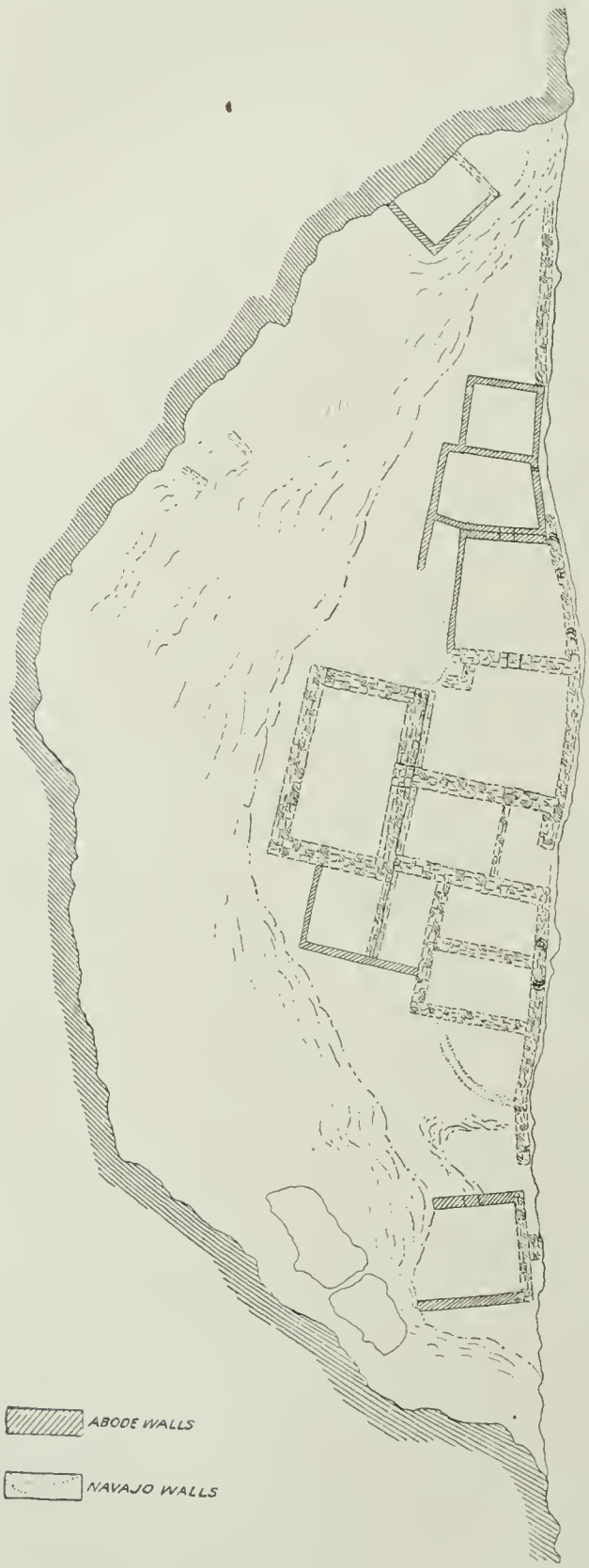


FIG. 15—Ground plan of the upper part of Casa Blanca ruin.

of plans of ruins, are of the highest importance. From them the sequence of construction can often be determined.

The walls of the lower ruin are somewhat obscured by loose débris, of which a large amount is lying about. Roof débris is especially abundant; it consists of small twigs and lumps of clay, with ends of beams projecting here and there. The principal walls occur in the eastern part, where some of them are 2 feet thick and still standing to a height of 10 and 12 and in one place of 14 feet. An inspection of the plan will show that, as is invariably the case where a wall rises to a height of more than one story, the lower part is massive and the upper wall sets back 5 or 6 inches, reducing its thickness by that amount. All the heavy walls occur either about the kiva or east of it. Apparently these walls were built first especially heavy and massive, and afterward, when upper stories were added, it was not found necessary to carry them up the full thickness. It will be noticed that the wall extending eastward from the corner of

the kiva, and which is from a foot to 6 feet high at the present time, extends through the heavy wall which crosses it 33 feet to the east, and is continuous to its termination about 50 feet east, against another heavy wall. The last-mentioned wall is also continuous from the cliff out to the front of the ruin, a distance of about 46 feet.

The heavy walls of the lower ruin are immediately under the upper cave. Back of them the cliff presents an almost smooth face of rock, 35 feet high and slightly overhanging. On this rock face there are marks which show that formerly there were upper stories, the rooms of which are outlined upon it. The rock surface was coated in places with a thin wash of clay, doubtless to correspond with the other walls of the rooms, but this coating was necessarily omitted where the partition walls and roofs and floors abutted on the rock. This is shown in plate XLVII. Although the marks are now so faint as to be easily overlooked, at a certain hour in the day, when the light falls obliquely on the rock, they can be clearly made out. At a point about 50 feet east of the kiva the structure was three stories higher than it is now. The roof of the upper story was within 4 feet of the floor of the cave, and under the gap or gateway in front of the main room above. West of this point there are the marks of but two stories additional. Farther west the structure rose again, but not to the height attained on the east.

The kiva was placed directly against the cliff. This is an unusual arrangement; but it will be noticed that the walls in front of it are of a different character from those on the east, and it is probable that when the kiva was built it opened to the air. The kiva is also anomalous in its construction. It presents the usual features of the inner circular chamber and an inclosing rectangular wall, but in this case the intermediate space was filled in solidly, and perhaps was so constructed. The kiva is still 6 feet deep inside, which must be nearly its maximum depth, and the roof was probably placed at a level not more than a foot or two above the present top. Whether the village was placed on a slight raise, or on the flat, level with the bottom land about it, and subsequently filled up with the débris of masonry, etc, can not be determined without excavation; but the top of the kiva is now 16 feet above the general level of the bottom land, and its bottom 10 feet above that level. It is possible that the kiva was much deeper than now appears, as no sign of the usual interior bench can be seen above the present ground surface, nor can any connection with the chimney-like structure to the south of it be determined, yet such connection must have existed. Probably not only this kiva but the whole ruin would well repay excavation.

The interior of the kiva was not exactly circular, being a little elongated northeast and southwest. The inclosing wall on the east is still standing in one place to a height of 5 feet above the top of the kiva structure, and about a foot above that level is marked by a setback, which reduces its thickness. Apparently the upper part was added at

a date some time subsequent to the completion of the kiva structure, as the wall on the south, now some 3 feet above the level mentioned, does not conform to the lower exterior wall on which it was placed. On the western side there is another fragment of the upper inclosing wall. Both this wall and the one on the south are less than 15 inches in thickness.

West of the kiva there are remains of other stone walls which differ in character from those on the east. They are now usually less than 3 feet high; they were 12 to 15 inches thick, and the lines are very irregular. South of the kiva, in the center of the ruin, there are other stone walls even thinner and more irregularly placed than those on the west, but most of the walls here are of adobe. As the use of adobe blocks is not an aboriginal feature, the occurrence of these walls is a matter of much interest, especially as they are so intimately associated with the stonework that it is not always an easy matter to separate them.

The occurrence and distribution of adobe walls is shown on the ground plan. They are not found as subordinate walls, dividing larger rooms, except perhaps in one instance; but apparently this method of construction was employed when it was desired to add new rooms to those already constructed. No room with walls constructed wholly of adobe can be made out, but walls of this character closing one side of a room are common, and rooms with two or even three sides of adobe are not uncommon. There are some instances in which part of a wall is stone and part adobe, and also instances in which the lower wall, complete in itself, is of stone, while the upper part, evidently a later addition, is of adobe; such, for example, is the cross wall in the eastern tier, about 30 feet from the cliff.

The mere occurrence of adobe here is evidence of the occupancy of this site at a period subsequent to the sixteenth century—we might almost say subsequent to the middle of the seventeenth; but its occurrence in this way and in such intimate association with the stone walls indicates that the occupancy was continuous from a time prior to the introduction of adobe construction to a period some time subsequent to it. This hypothesis is supported by other evidence, which will appear later. Attention may here be directed to the fact that there are four chimney-like structures in the lower ruin, all of adobe, and all, except the one which pertains to the kiva, attached to adobe walls.

On the western margin of the ruin, and nowhere else within it, there are traces of another kind of construction which was not found elsewhere within the canyon. This method is known to the Mexicans as "jacal," and much used by them. It consists of a row of sticks or thin poles set vertically in the ground and heavily plastered with mud. At present not one of these walls remains to a height of 6 inches above the ground, but the lines of poles broken off at the ground level are still visible. The ground at this point is but 3 or 4 feet above the general level of the bottom. The ground plan shows the occurrence of

these wall remains on the western edge of the site. They are all outside of but attached to what was formerly the exterior wall on that side.

There are remains of four Navaho burial cists in the lower ruin, at the points shown on the ground plan. These are constructed of stones and mud roughly put together in the ordinary manner, forming thin, rounded walls; but these can not be confounded with the other methods of construction described. Three of the cists have long been in ruins and broken down; the one on the east is but a few years old.

Access to the upper ruin can now be had only with much difficulty. In the western end of the cave there is a single room placed on the cliff edge, and between this and the end of a wall to the right a small stick has been embedded in the masonry at a height of about 2 feet from the rock. The cliff here is vertical and affords no footing, but by throwing a rope over the stick a man can ascend hand over hand. During the period when the houses were occupied, access was had in another and much easier way, through a doorway or passageway nearly in the center of the ruin and directly over the point where the lower village was four stories high. The roof of the lower structure was less than 4 feet below the floor of the cave; yet there is no doubt that a doorway or passageway existed also at the western end of the cave, as the western end of the wall on the right of the stick is neatly finished and apparently complete.

The principal room in the upper ruin is situated nearly in the center of the cave, and is the one that has given the whole ruin its name. The walls are 2 feet thick, constructed of stone, 12 feet high in front and 7 feet high on the sides and inside. The exterior was finished with a coat of whitewash, with a decorative band in yellow; hence the name of Casa Blanca or White House. West of the principal room there is a smaller one, which appears to be a later addition. The walls of this room are only 7 inches thick, of adobe on the sides and back and of small stones in front. The top of the wall is about 2 feet below the top of the wall on the east. The coat of whitewash and the yellow decorative band are continuous over both rooms, but the white coat was also applied to the exterior western wall of the main room. In the main room there is a series of small sticks, about half an inch in diameter, projecting 8 inches from the wall and on a line 3 or 4 inches under where the roof was.

The small room in the eastern end of the cave was located on a kind of bench or upper level, and was constructed partly of stone and partly of adobe. The stone part is the upper portion of the eastern half. On the west there is a small opening or window, with an appliance for closing it. It is probable that this room was used only for storage. In the western end of the cave there is another single room, which is clearly shown in plate XLVII. The front wall is 11 feet high outside and 5 feet high inside. The lower portion is stone, the upper part and sides are adobe, and the side walls rest on nearly 2 feet of straw, ashes,

etc. The buttress shown in the illustration is of stone and the front wall that it supports is slightly battened. A close inspection of the illustration will show that this wall rests partly on horizontal timber work, a feature which is repeated in several walls in the main cluster of the ruins.

The use of timber laid horizontally under a wall is not uncommon, and as it will be discussed at greater length in another place, it may be dismissed here with the statement that as a rule it failed to accomplish the purpose intended. But the use of the buttress is an anomalous feature which it is difficult to believe was of aboriginal conception. Its occurrence in this ruin together with so many other unaboriginal features is suggestive.

The walls of the principal room and of the rooms immediately in front of it are constructed of stone; all the other walls in the upper ruin are of adobe or have adobe in them. The two rooms on the east and two walls of the room adjoining on the west are wholly of adobe, about 7 inches thick and now 3 and 4 feet high. In the southeast corner of the second room from the east there is an opening through the front wall which may have been a drain. It is on the floor level, round, 5 inches in diameter, and smoothly plastered. In the fourth room from the east there is a similar hole. Both of these discharge on the edge of the cliff, and it is difficult to imagine their purpose unless they were expedients for draining the rooms; but this would imply that the rooms were not roofed. Although the cliff above is probably 500 feet high, and overhangs to the degree that a rock pushed over its edge falls 15 feet or more outside of the outermost wall remains, and over 70 feet from the foot of the cliff, still a driving storm of rain or snow would leave considerable quantities of water in the front rooms if they were not roofed, and some means would have to be provided to carry it off.

In the same room, the fourth from the east, there are the remains of a chimney-like structure, the only one in the upper ruin. It is in the northeast corner, at a point where the wall has fallen and been replaced by a Navaho burial cist also fallen in ruin, and was constructed of stone. There is no doubt that it was added some time after the walls were built, as it has cracked off from the wall on the east, which shows at that point its original finish. In the eastern wall of this room there is a well-finished opening, and at the corresponding point in the wall of the room on the right, the third wall from the east, there is another. The latter wall is of adobe, or rather there are two adobe walls built side by side; one, the eastern, considerably thinner than the other. The opening extends through both walls; it was neatly finished and was closed by a thin slab of stone plastered in with mud. It has the appliance for closing mentioned above and described later (page 165). Most of the openings in the walls appear to have been closed up at the time the houses were abandoned.

The front wall of the main room is 12 feet high in front and was stepped back 6 inches at half its height from the ground. The step-back is continued through the front wall of the small room on the west. Near the center of the main room there is a well-finished doorway, directly over the point where a cross wall in front of it comes in. This opening was originally a double-notched or T-shape doorway, but at a later period was filled up so as to leave only a rectangular orifice. The principal entrance to the upper ruin was in front of this opening and a little to the left of it. It will be noticed from an inspection of the plan that the room into which this entrance opened was divided at a point about 4 feet back from the cliff edge by a stone wall not more than half the thickness of the walls on either side of it. This cross wall is still 6 feet high on the side nearest the cliff, but there is no evidence of a doorway or opening through it. The back rooms must have been reached by a ladder in front, thence over the roof of the room. The cliff entrance was a narrow doorway left in the front wall. The ends of the walls on either side were smoothly finished, as in the western doorway.

There are many lumps of clay scattered about on the ground, some showing impressions of small sticks. Apparently they are the débris of roofs. There are also some fragments of pottery, principally corrugated ware. The adobe walls in the upper ruin rest generally on rock, sometimes on ashes and loose débris; in the lower ruin they rest usually on stone foundations. The occurrence in this ruin of many features that are not aboriginal suggests that it was one of the last to be abandoned in the canyon, but there are certain features which make it seem probable that the upper portion continued to be inhabited for some time after the lower portion. The contrivance for closing openings is identical with examples found in the Mesa Verde region, and it is probable that an intimate connection between the two existed.

III—HOME VILLAGES LOCATED FOR DEFENSE

The distinction between home villages located on bottom lands absolutely without reference to the defensive value of the site, and other villages located on defensive sites, is to some extent an arbitrary one. The former, which are always located at the base of or under an overhanging cliff, sometimes occupy slightly raised ground which overlooks the adjacent land, and the latter are sometimes so slightly raised above the bottoms they overlook as hardly to come within the classification. Moreover, ruins in their present condition sometimes belong to both classes, as in the example last described. Yet a general distinction may be drawn between the classes, in that the former are generally located directly upon the bottom land and invariably without thought or regard to the defensive value of the site, while in the latter the effect of this requirement is always apparent.

The class of ruins which has been designated as the remains of villages located for defense comprises all the most striking remains in the

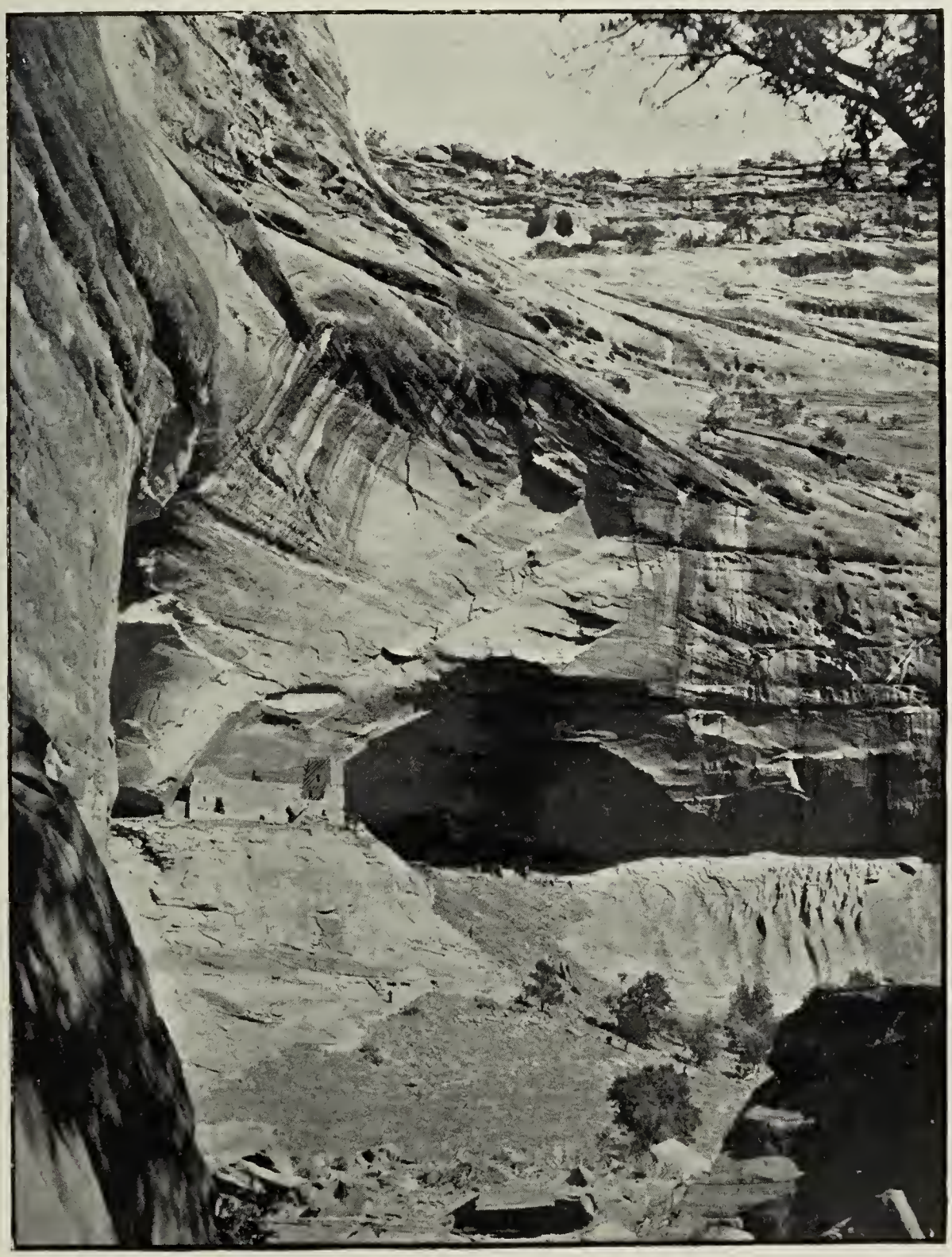
canyon, many of which may properly be termed cliff ruins. The characteristics of the class are: A site more or less difficult of access—generally an elaborate ground plan, although sometimes they consist of only a few rooms—and the invariable presence of the kiva or estufa, here always circular in form. The largest ruin of this class occurs in Del Muerto, and is known as Mummy Cave ruin. It is called by the Navaho Tse-i-ya-kin. It is situated in the upper part of the canyon, near the junction of a small branch, and has an extensive outlook.

At a height of about 80 feet above the top of a gentle slope of earth and loose rock, and perhaps 300 feet above the stream bed, there are two coves in the rock, connected by a narrow bench. The western cove is about 100 feet across and its back is perhaps 75 feet from the front wall of the cliff. The eastern cove is over 200 feet across and perhaps 100 feet deep, while the connecting ledge is about 110 feet long. Ruins occur on the central ledge and on similar ledges in the back parts of both coves.

The western or smaller cove is accessible only from the ledge, which in turn can be approached only from the eastern cove. The smaller cove had a row of little rooms across the back and there are traces of walls on the slope in front of these. Fourteen rooms can now be made out on the ground; altogether there may have been 20 rooms in this portion. Practically all the available space on the ledge was occupied by rooms, and 10, all of considerable size, can now be traced. The total number in this portion was 14 or 15. The eastern cove contained the largest part of the settlement. The back part is occupied by a ledge about 50 feet wide entirely covered by remains of walls. Some 44 rooms can now be made out on the ground, in addition to 3 or perhaps 4 circular kivas, and the whole number of rooms may have been 55. Assuming, then, that the various portions of the ruin were inhabited at the same time, we would have a total of 90 rooms; but, as many of them could be used only for storage, the population could not have been more than 60 persons.

The rooms in the western cove are fairly uniform in size and were probably habitations, for they are all too large to be classed as storage rooms. There was no kiva in this portion, however, nor any unoccupied place where a kiva might have been placed. It seems clear, therefore, that this portion was either an appendage of the other or was occupied at a later period; in either case it was constructed at a date subsequent to the remains in the eastern cove.

The intermediate ledge, which is about 110 feet long and about 30 feet wide, was practically all occupied by a row of seven rooms, some of them of more than one story. These rooms are exceptionally large—larger than any group of rooms in the canyon or in this part of the country. The outside or front wall is more than 20 feet from the cliff back of it, and the rooms are from 10 to 15 feet wide. Figure 16, which is a ground plan of the ruin, shows the exceptional size of



MUMMY CAVE, CENTRAL AND EASTERN PART

these rooms. All of them were at least two stories high; some were three. The walls in this portion are generally 2 feet or more thick and exceptionally well constructed. Its eastern end is still standing to a height of three stories, and carries a roof intact, giving a tower-like effect to that portion. Originally this portion rose but one story above the other rooms. Throughout nearly all its length the front wall shows part of the upper story, which is also marked on the cliff wall by a thin wash of clay, in the same manner as in the Casa Blanca ruin. The two rooms west of the tower were surmounted by a single large room. The cliff wall is coated with a thin wash of yellowish clay, and no mark of a cross wall or partition can be seen upon it. There are no openings between the three eastern rooms on the ground floor. The first room to the west of the tower has a square chimney-like shaft, and a niche or alcove connected with it. The second room also has a niche and a rounded shaft. The third room has neither niche nor shaft.

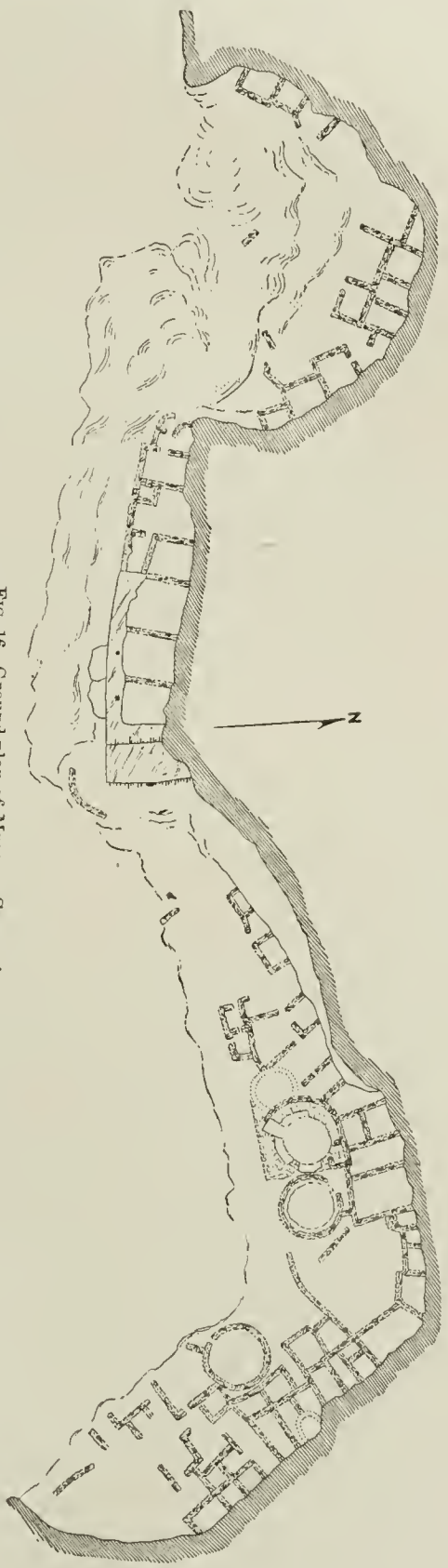


FIG. 16—Ground plan of Mummy Cave ruin.

The front wall was exceptionally heavy, but the upper portion has fallen inward, forming a heavy mass of débris against it. The east and south sides of the tower, for about 5 feet of its height, are decorated by inlaying small stones 1 to 2 inches long and half an inch thick. The same decoration occurs at intervals down the front wall, but irregularly. This feature is not chinking, such as has been described, and has no constructive value, but is purely decorative. Back of the rooms west of the tower there are some old pictographs on

the cliff wall at the place where the roof abutted on it. Here the wash of clay before mentioned was necessarily omitted. In the first room there is a pictograph of a man, in the second a semicircle, both done in light-green paint.

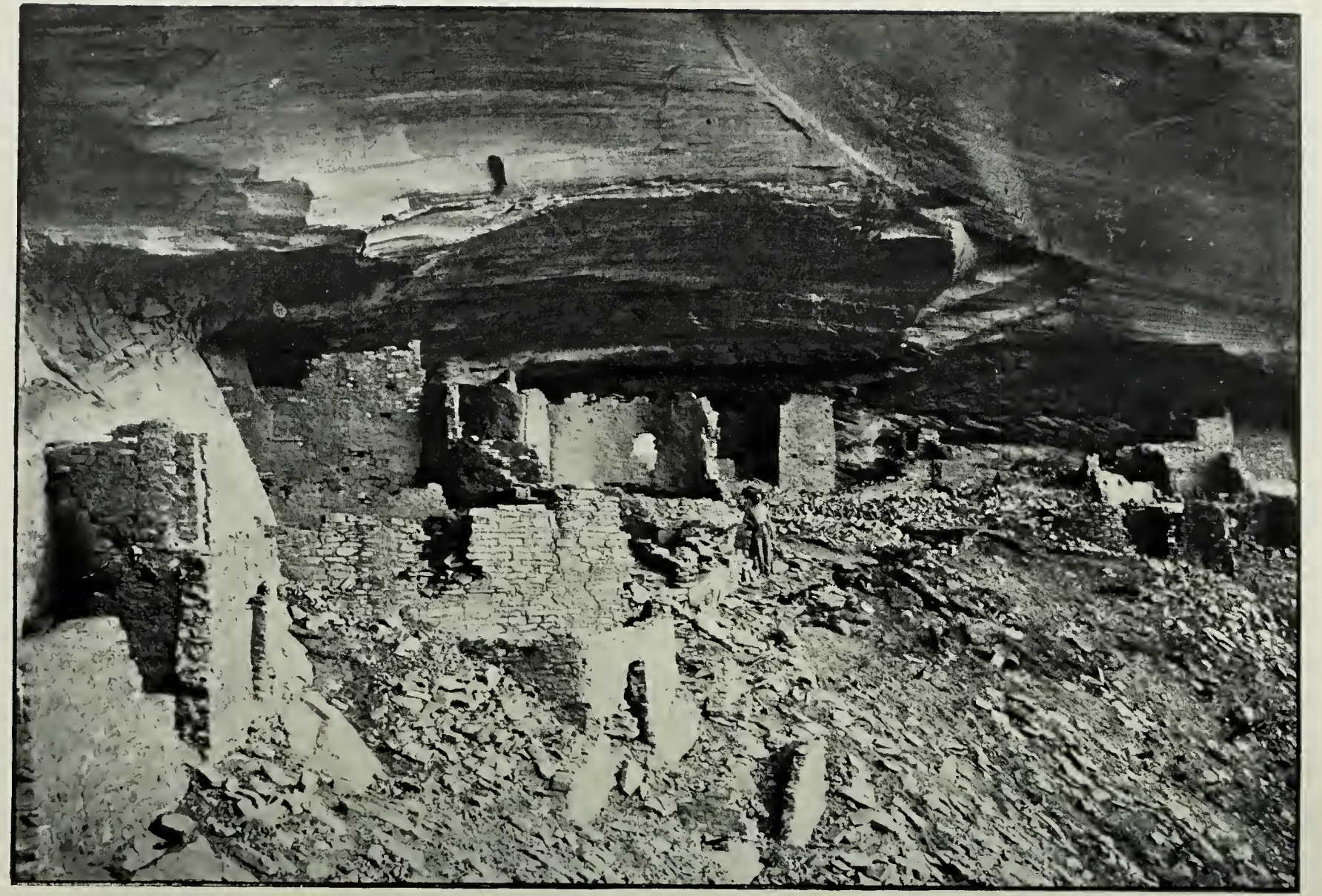
The lower part of the outer corner of the tower has fallen out. At this point there was a small doorway or opening, which was the only entrance on the south or east. The corner which has fallen was apparently supported by three or four sticks laid horizontally on the rock at an angle of 45 degrees with either wall. The giving way of the timber support apparently caused the fall of the corner, but why a structure otherwise so substantial should be placed on such frail support, when a filling of masonry was both easy and practicable, is not clear.

The doorway mentioned is the only opening into the ground-floor room in the tower. Connection with the rooms on the west was through a large doorway in the western wall of the second story, and in the story above there was a similar opening. These are shown in plate XLVIII, which is a general view of the central portion of the eastern cove.

The lintels of the openings in the central part are formed of round sticks, about 3 inches in diameter, matched, and bound together with withes. These withes may be seen in places where the mud plaster has fallen away. The stick lintels occur only in the central portion; the windows and doorways of the other portions of the ruin, some fine examples of which remain, are always finished with stone lintels and sometimes with stone jambs.

A little east of the center of the front wall there is a large rock, or rather a pile of large rocks, near the outer edge of the ledge. This is shown in the illustration. Instead of removing this obstruction the wall was built under and over it. Near the western end of the front wall there is a large doorway or opening. Access to the western cove was along the narrow edge of the ledge under the front wall, thence through this doorway. The doorway gave entrance to a very narrow space, less than 4 feet square, surrounded by a heavy wall with a doorway through the left or western wall into the last apartment of the series. Through the western wall of this apartment a doorway opened on the end of the ledge and the western cove. This principal entrance is shown in plate XLVIII. Its size is exceptional, it being about 6 feet high. A little below the top there is a single stick across it, and a similar contrivance was found in place in the openings in the tower, but it does not occur in the opening in the cross wall. The same feature is found in the modern pueblos, where the stick forms the support of a blanket draped to close the opening.

A little east of the doorway in the front wall there is a small opening near the ground, through which can be seen what appears to be a roof. It is but 2 feet above the ground, however, and very roughly constructed. It consists of a layer of cedar logs; above this a layer of small sticks, and above this again slabs of stone and mud. It occurs



EASTERN COVE OF MUMMY CAVE

under a narrow room or passage, shown on the plan, and seems to have been the floor of that room rather than a roof of a space below.

Roofing or flooring beams project from the tower on three sides. They are all rounded and carefully selected or matched. Those of the lower story or first roof are 4½ inches in diameter, those of the story above about 3 inches, while those of the roof, which occur in pairs, are about 2½ inches. They all, except those of the lower story, project about 2 feet from the wall. All the beams are from 18 inches to 2 feet apart, and the roof is formed of canes or willow sticks less than half an inch in diameter laid very neatly in patterns. The work here is by far the best in any part of the canyon. The beams of the first floor are represented only by the ends which pass through the walls, the middle portion being gone.

The cliff wall forming one side of the rooms in the tower was coated with a wash of yellowish clay to correspond with the other sides. It shows bare rock at the points where the floors abutted against it. The roof of the second story or middle room was 10 inches thick, and the marks are on the same level as those of the rooms over the west of the tower. There are also beam holes in the third story about 4 feet above its floor, but extending only from the cliff out to its opening.

A singular feature occurs in the tower, which is difficult to explain. The upper part of the third-story room was coated in the interior with whitewash, which appears to have been carelessly applied. Small quantities struck the setback at the floor level and spattered over the wall below—that of the second-story room. In one case a considerable quantity of the whitewash struck the top of a beam in what would be the roof of the second story and scattered over the wall surface below it. It is therefore clear that at the time when the whitewash was applied, which was either at the time or subsequent to the habitation of the rooms, there was no floor to the third-story room nor roof to the second story. The stains of whitewash never go below the floor level of the second story.

The house remains in the eastern cove are partly shown in plate XLIX, which is from a photograph. The point of view is from the ledge in front of the tower. The ruins rest on a ledge in the back of the cove formed of débris well compacted and apparently consisting partly of sheep dung. The rooms are small, sometimes three deep against the back of the cove, and many of them could only have been used for storage. The principal structure is the western kiva, with its chimney-like attachments. This is described at length on pages 177, 179, 186, and 187. Adjoining it on the east is another kiva, part of whose wall is still two stories high, and clearly shown in the illustration. Some 50 or 60 feet to the east or southeast there is another circular structure, which apparently had no interior bench. The small semicircular structure shown on the plan and in the illustration, which rests against and is roofed by the rock, is a Navaho burial cist, and

another of these cists, of large size, occurs west of the principal kiva; but the ruin as a whole contains much less evidence of Navaho work than those farther down the canyon.

Many of the walls are built entirely of small pieces of stone, not more than 3 or 4 inches long by 2 inches wide and half an inch to an inch and a half thick. This construction is especially noticeable in inner walls. The joints are carefully plastered, evidently with the hand, but the mud is seldom allowed to cover the stone. It appears to have been applied externally, in pellets about the size of a walnut. The general thickness of walls is about 15 inches, although on the intermediate ledge they are over 2 feet, but some of the less important walls consist of a single layer, 6 to 8 inches thick. Walls are sometimes seen here supported by vertical timbers incorporated in them after the manner later described at some length. Ends of logs project here and there from the débris on the slope, but probably many of them are the débris of roofs.

The peculiar and anomalous features presented by the remains on the intermediate ledge seem to require some explanation. This portion of the ruin is not only different from the other portions, but different also from anything else in the canyon, and the difference is not one of degree only. Doubtless systematic excavation in the various parts of the ruin would afford an explanation. In the absence of such work we can only speculate on the problem.

The occurrence of two chimney-like shafts in connection with the rectangular rooms west of the tower is significant. Nowhere else in the canyons, except in the Casa Blanca ruin, do these structures occur, so far as known, except in connection with circular kivas. As regards the ruin named, it is almost certain that it was occupied in the historic period, probably in the seventeenth century.

The division of the ruin into three separate parts, the absence of kivas in the western cove, and the method of access to that portion all attract attention. If there were monks or other Spaniards in the settlement, the explanation would be plain; they and those of the natives allied with them would occupy the central ledge, and the anomalous features would be natural under the circumstances. Such a hypothesis would explain also the source of the many unaboriginal features which are found in other parts of the canyon, but there is no direct evidence to support it. It should be mentioned, however, that the walls here rest on about half an inch of substance which resembles compacted sheep dung. If the substance is really such, the walls must have been built within the historic period.

At the point marked 48 on the map there is a ruin which resembles somewhat in its location an example previously described (page 98). It is situated in a cove in a jutting point of rock, forming part of the talus slope, and is about 20 feet above the bottom, which it overlooks. Figure 17 shows the character of the site, and figure 18 is a

ground plan. At the back of the cove a row of small rooms, five or six in number, was built against the rock. In front of these there were two kivas and perhaps other rooms. Only fragments of these now remain, but it can still be seen that both kivas had interior

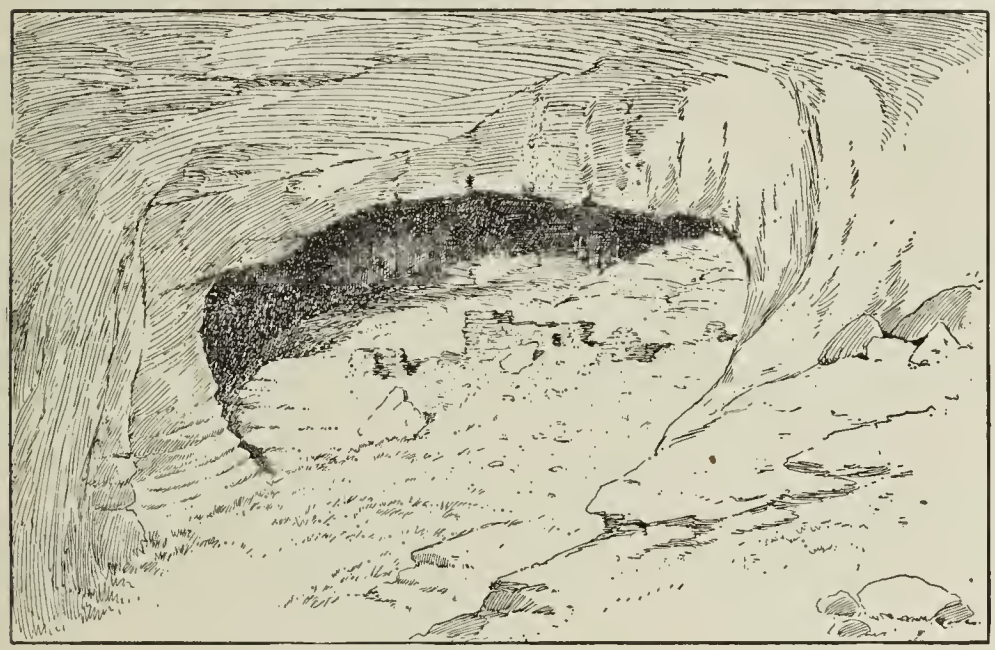


FIG. 17—Ruin in a rock cove.

benches, and that the western one has been plastered with several successive coats—at least four. There are no pictographs on the back wall, and but little staining by smoke. The masonry is rather rough, consisting of large stones, pretty well chinked with small spawls.

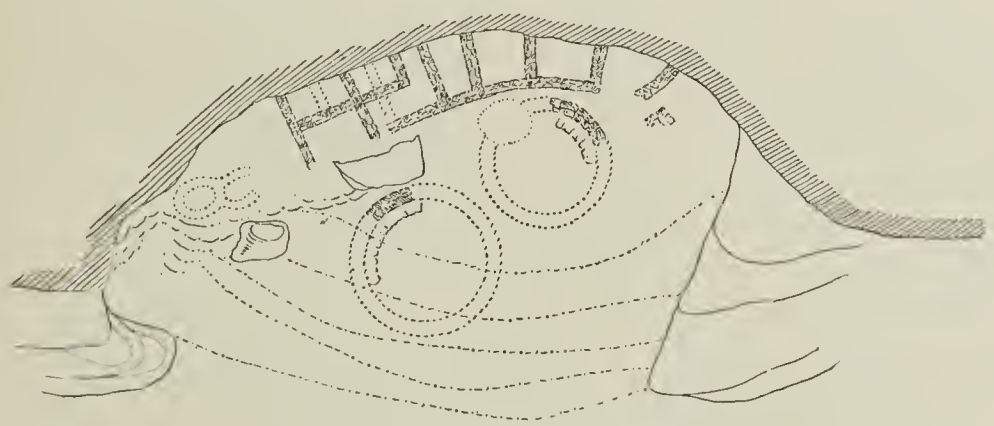


FIG. 18—Ground plan of a ruin in a rock cove.

Some of the walls were plastered. The western end of the ruin has been partially restored by the Navaho and used for burial cists, and other cists have been built on the site independent of the old walls, as shown on the plan. Figure 19 is a ground plan of a ruin on a

ledge near the mouth of Del Muerto, at the point marked 15 on the map. It is situated at the back of a considerable bay, directly opposite a large rock at the mouth of Del Muerto, and overlooked the whole of the bottom land in the bay. The houses were built on a bench or ledge, about 30 feet wide, overhung by the cliff above and dropping down almost vertically to the bottom land, about 40 feet below, but on the east access to the bench was easy by a slope of talus extending up to it. The site was covered with bowlders, and walls have been built over and under them. The masonry is good, and was composed of larger stones than usual, carefully chinked with spalls, the work being well done.

There were but 10 rooms on the ground, in addition to one circular kiva; some of these rooms are too small for habitation, and one of them appears to have been a rectangular kiva. On the same bench, about 100 feet westward, however, there are traces of other rooms, the walls of which were very thin. The cliffs back of the ruin and for 200 feet west of it are covered with pictographs in white and colors.

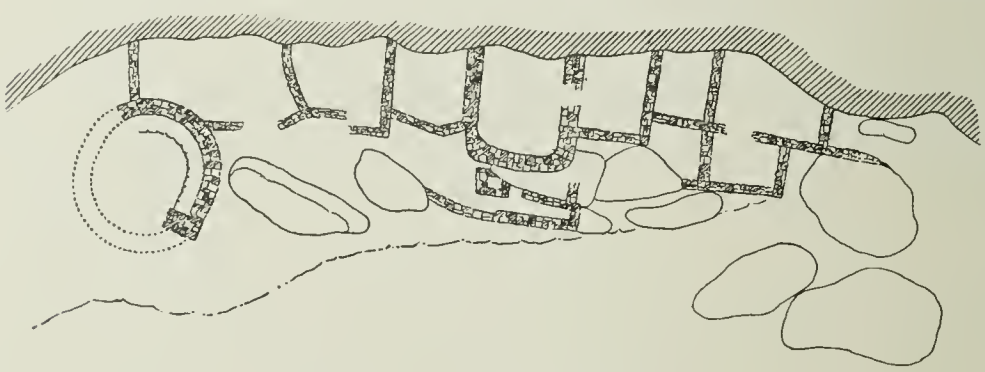


FIG. 19—Ground plan of a ruin on a ledge.

Near the center of that portion of the ruin shown on the ground plan there is a large room which may have been a rectangular kiva. The walls are over 2 feet thick in the first story, diminishing at the roof level by a step or setback to the ordinary thickness of about a foot. These walls, as usual in such structures, were about 2 feet thick; they are slightly curved, the front wall markedly so, and the interior corners are well rounded. No reason for this curvature is apparent, and it is certainly not dictated by the occurrence of the rock over which the wall is built, as only the point of this rock comes through the wall in the western side of the front wall. There may have been an opening into the room through the eastern wall connecting it with the room on that side, as the masonry is there broken down; but this is doubtful, as the eastern room itself has no exterior opening. It is more probable that the large room was entered through the roof, for the thin wall of the second story shows in front one side of a well-finished doorway.

Just outside of the heavy front wall there is a round hole in the ground, the remains of a vertical shaft connected with the interior of the room. The hole is about a foot in diameter, and is neatly plastered

inside, and appears to have been a chimney or a chimney-like structure such as occur in connection with the kivas in other ruins. It will later be discussed in detail.

The circular kiva occupies the western end of that part of the room shown in the plan. It was 15 feet in diameter, and is exceptionally well built. The wall is standing for about half of its circumference, and was so neatly finished that the interior coating of plaster was apparently omitted. There are no traces of inclosing rectangular walls; the thickness of the kiva walls and the exceptionally large stones used in parts of it suggest that the kiva stood alone. So far as the walls remain standing, an interior bench can be traced, about 2 feet wide and 6 feet below the top of the outside wall. On the southeastern side, in the interior, there is a buttress or projection, which terminates the bench at this point.

The walls between the rectangular room described and the circular kiva are thin and very irregularly laid out. In front of the rectangular room and on the edge of the bench, which is here but a few feet above the talus, a rather heavy wall has been built over the top of a rock,

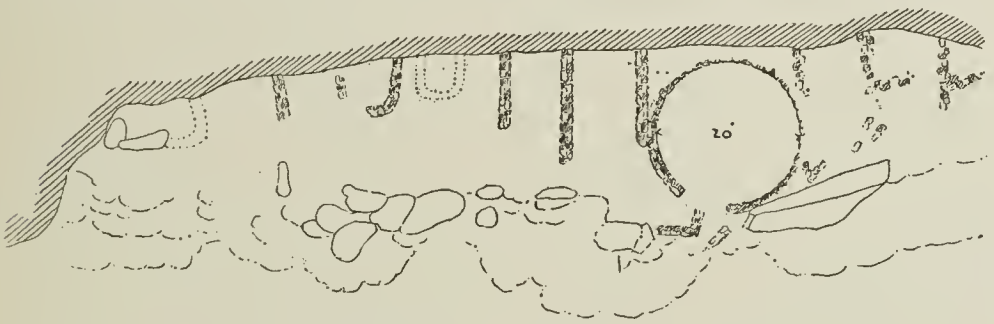


FIG. 20—Ground plan of ruin No. 31, Canyon de Chelly.

and inside or to the north of it another wall has been placed, hardly 2 feet distant. These walls are connected at the eastern end by a thin cross wall, now but slightly above the ground surface and notched like a doorway. Below the notch a slab of stone has been placed and was apparently used as a step. The purpose of these walls is not clear, but they may have constituted an entrance or passageway to the village. If so, we have here a very efficient defensive expedient and a decided anomaly in cliff-village architecture.

At the point marked 31 on the map there is a small ruin on a ledge about 150 feet above the bottom and difficult of access. The site overlooks considerable areas of bottom land on both sides of the canyon, and was probably connected with and formed part of a larger ruin on the same ledge and east of it, which will next be described. On this site there are remains of half a dozen rooms or more and of one circular kiva, which was 20 feet in diameter. (See ground plan, figure 20.) The site has been much filled up, and the kiva appears as a cylindrical depression, flush with the ground outside, but 3 to 5 feet deep inside. The walls are rather thin and smoothly plastered inside. On the south

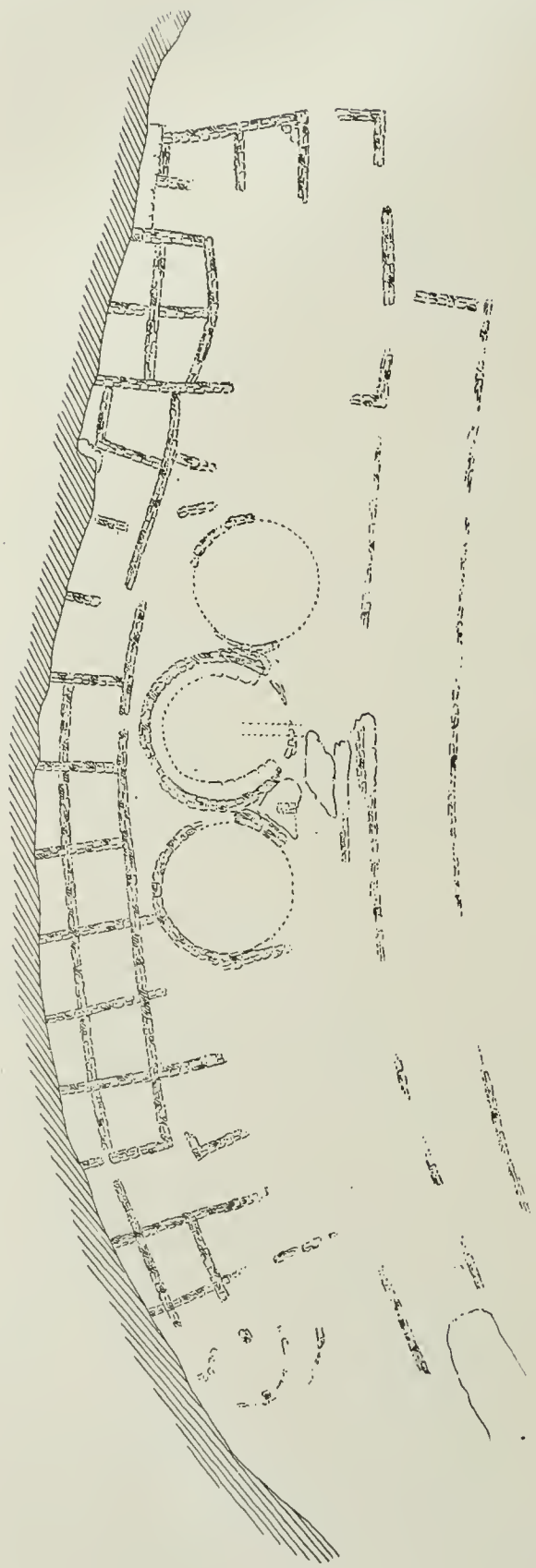


FIG. 21.—Ground plan of ruin No. 32, Canyon de Chelly.

side there is an opening extending down to the floor level and opening directly on the sharply sloping rock. This feature will later be discussed at some length. The walls to the west of the kiva are still 14 or 15 feet high, showing two stories, and were well constructed and smoothly plastered. The interior of the kiva shows a number of successive coats of plastering—at least eight.

Immediately above the last-mentioned ruin, and on the same ledge, occur the remains of a large settlement, shown in plan in figure 21. It will be noticed that here, as in some of the previous examples described, the general arrangement consists of a row of rooms against the cliff, with the kivas in front. There were at least 17 rooms in line, and there may have been as many as 30 to 50 rectangular rooms in the village, scattered over an area nearly 200 feet long by 65 feet wide, but not all of this area was covered. Three kivas are still clearly shown.

This ruin is especially interesting on account of the site it occupies. The walls were placed on sharply sloping rock and in some cases on loose débris, and numerous expedients were resorted to to prevent them from slipping down the slope. The

fact that these expedients were not successful makes them more interesting. Upright logs were inclosed in the walls and anchored in holes drilled in the rock below; horizontal logs were built into the masonry as ties and placed below it, and heavy retaining walls were erected. These constructive expedients will later be discussed at greater length.

The whole slope is more or less covered with débris, and there is no doubt that this was at one time a considerable settlement. The cliff walls near the east end show traces of two stories, and in one place of three stories, which formerly rested against them. Moreover, the number of successive coats of plaster in the kiva shows an extended occupancy, an inference which is further supported by the variety of expedients which were adopted to hold the walls in place.

The marked irregularity of the five eastern rooms as compared with the regular series west of them will be noticed on the plan. These eastern rooms must have been added at a period subsequent to the completion of the others. The marks of a second and third story occur on the cliff back of this cluster, and there is no doubt that it was an important part of the settlement. West of the area shown on the plan traces of walls occur on the slope and among the débris for a distance of over 100 feet.

Parts of three kivas can now be seen on the ground, and this was probably the total number in the settlement. The fronts of all of them have fallen out, notwithstanding various expedients that were employed to hold them in place. The western wall of the western kiva is part of the rectangular system and was apparently in place before the kiva was built. A triangular block which formed the junction in front of this kiva and the central one has slipped down and new walls were afterward built to restore the kivas to their original shape. The central kiva has an interior bench, which was, however, added after the structure was completed, and in fact after the front had been replaced. The second falling off of the front has left a fine section of the wall, and the changes which have taken place are plainly shown in it.

That the interior bench was added long after the original kiva had been completed and occupied is shown by the occurrence between it and the wall of nearly an inch of plaster composed of separate coatings, each smoke-blackened, varying from the thickness of a piece of heavy paper up to an eighth of an inch or more. If one of these coatings were added each year, twelve or fifteen years at least must have elapsed between the building of the kiva and the construction of the interior bench. The original floor of the kiva was composed of a layer of mud mortar about an inch thick, and extends through under the bench, the top of which is about 3 feet above it. Under this floor there is a straight wall at right angles to the cliff and extending some 4 feet toward the center of the kiva; what is left of it is just under the floor level.

There is a suggestion in this that the site of the kiva was originally occupied by rectangular rooms, and there is a further suggestion, in the end sections referred to, that the kiva had at some period fallen into decay and was subsequently rebuilt. All this occurred before the first falling out of the front.

The section shows that the original walls were not so thick as the present ones, and that there was formerly a slight setback in the wall of $2\frac{1}{2}$ or 3 inches at the level of the present bench, reducing the thickness of the wall by that amount. The original outside wall on the east extends only 6 inches above this setback. The upper portion of the exterior wall was added at the same time that the bench was constructed and is the same thickness as the lower part of the original wall. Figure 22 will make clear the changes which have taken place. There was a recess of some kind in the original wall on the east and a similar one on the west side, but they have been filled up by the later additions. The upright logs which were built into the masonry are incorporated in the older walls. Under the floor, and apparently under the walls themselves, there is a layer nearly a foot thick of loose débris consisting of cornstalks, corn leaves, ashes, and loose dirt. The floor of the east circular room, which still covers about half the interior, rests similarly on a layer of ashes. The expedients employed to hold the front walls of these kivas in place are later discussed at some length.

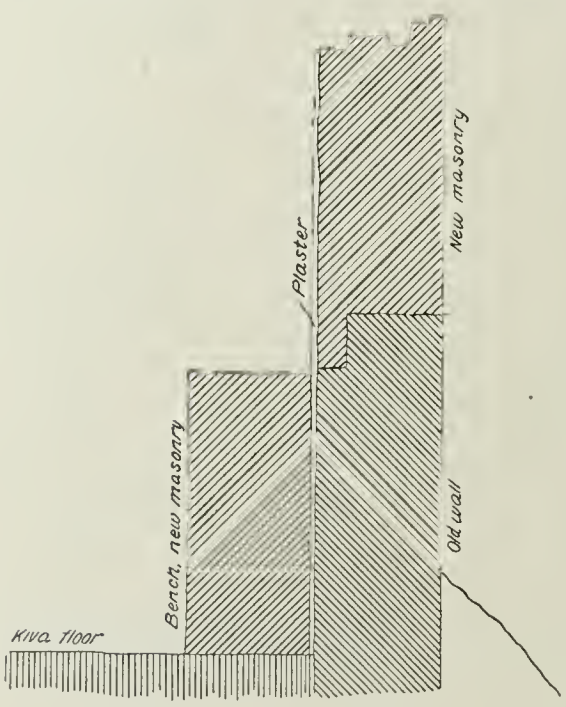


FIG. 22—Section of a kiva wall.

Figure 23 shows the character of site occupied by a village ruin of some size situated in the first cove in the cliff wall below the mouth of Canyon del Muerto. The cliff here is about 300 feet high and the ruin is located on a ledge in a cove about 70 feet above the stream bed. Although seemingly very difficult to reach, the ruin is of comparatively easy access without artificial aid. The cavity was caused apparently by the occurrence of a pocket of material softer than that about it, and this softer material has weathered out, showing very strongly the lines of cross bedding, which, in the massive rock on either side, have been almost entirely obliterated. The strata are inclined at an angle and the edges project from a few inches to about a foot, forming a series of

little benches tilted up at an angle of about 45 degrees. By the exercise of some agility, one can ascend along these benches. About halfway between the site of the ruin and the stream bed there is a narrow horizontal bench, and again halfway between this bench and the ruin there is another, about 55 feet above the stream. Access to the ruins is greatly facilitated by these intermediate ledges.

The bench on which the ruin occurs is about 250 feet long and generally about 20 feet wide, the surface being almost flat. There are structures on the extreme northern and on the extreme southern ends, but a considerable part of the intermediate area was not occupied. Reference to the ground plan (figure 24) will show that most of the buildings occur on the northern half of the ledge, which was fairly

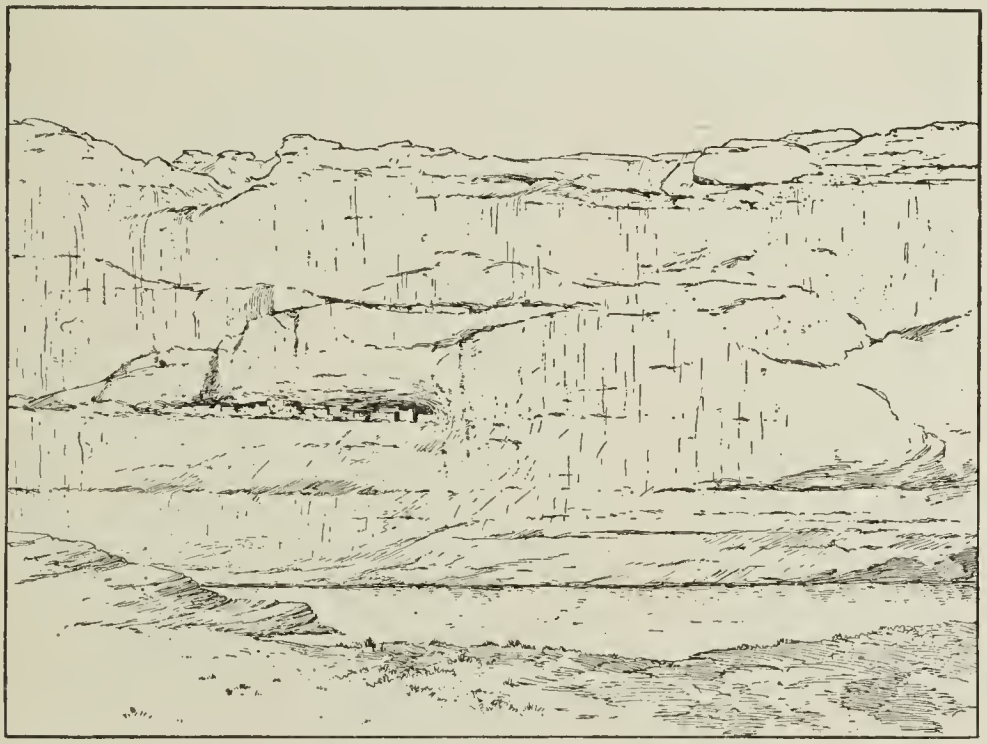


FIG. 23—Ruin No. 10 on a ledge in a cove.

well filled by them. Many of the walls in this portion are apparently underlaid by a foot or more of ashes, sheep dung, domestic refuse, cornhusks, etc.

The room which is shown in the center of the plan, at the southern end of the main group, stood alone and was the largest rectangular room in the village. It covered an area 15 feet by 9 feet inside the walls, which are now 5 or 6 feet high. The masonry is very good, although chinking with spalls was but slightly employed to finish the exterior; inside it is more apparent. The western wall was built over the edge of the sloping rock forming the back of the cove, as shown on the plan, and this rock projects below the wall into the room. There were apparently no openings in the walls, except some very small ones on the

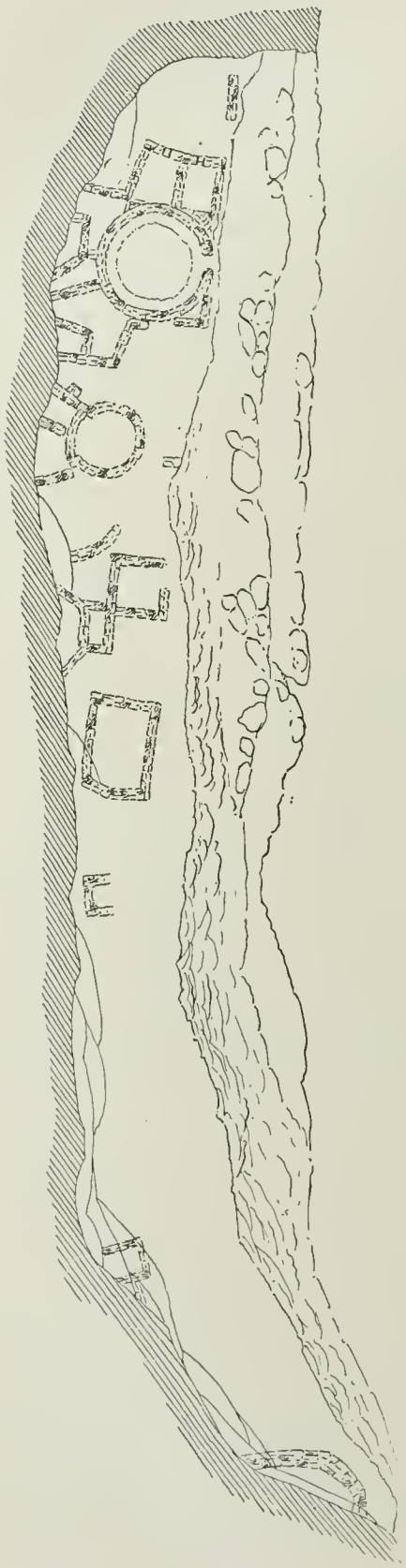


FIG. 24—Ground plan of ruin No. 10.

eastern side, near the floor level. In the southern wall a piece of rough timber was inlaid in the masonry, about 5 feet above the floor, flush with the wall inside and extending nearly through it. This piece of timber was crooked and its bend determined the wall line, which is bowed outward, as shown on the ground plan. This feature will be discussed later.

There were two circular kivas in the village, one of which was unusually small, being only about 10 feet in diameter north and south; the east-and-west diameter is a trifle smaller. There was apparently no bench in the interior, but on the western or northwestern side there is a bench-like recess of about a foot which occupies 7 feet of the circumference. The whole interior was covered with a number of washes of clay, applied one over another, forming a coating now nearly three-quarters of an inch thick. This is cracked and peeled off in places, and in the section eighteen coats, generally about one thirty-second of an inch thick, may be counted. Each coat or plastering is defined by a film of smoke-blackened surface.

On a level about 2 feet above the bench and about 5 feet above the present ground surface, there seems to have been some kind of roof. The stones here project into the interior slightly beyond the wall surface, and the plaster seems to curve inward. This point or level is from 6 to 18 inches below the top of the wall, and here there are remains of occasional small sticks, about an inch in diameter, which projected into the kiva. They are irregularly disposed

and probably had no connection with the roof, but there are no traces of heavier timbers above them. In the interior a white band with points completely encircled the kiva. The top of this band is about a foot above the present ground surface and about 18 inches below the bench on the western side. It is illustrated in figure 72.

The exterior wall of the kiva was very roughly laid up, and some of the lower stones were set on edge, which is rather an anomalous feature. There is no evidence that the structure was ever inclosed in rectangular walls, as was the usual custom; in fact, the occurrence of other walls near it would apparently preclude such an arrangement. The wall which runs north or northwest from the kiva, joining it to the cliff wall behind, is pierced by a doorway some feet above the ground, and in front of or below this doorway there is a buttress or step of solid masonry, shown on the plan. There was apparently an open space between this doorway and the next wall to the north. The room entered through the doorway was very small, and its roof, formed by the overhanging cliff, is much blackened by smoke.

The main or north kiva was 15 feet in diameter on the floor, with a bench a foot wide extending around it. The external diameter is over 20 feet. The interior was decorated by bands and dots in white, which are described at length in another place (page 178). The roof was 5½ feet above the bench, and there is a suggestion that it rested on a series of beams extending north and south, but this is not certain.

On the southeastern side, at the point where the kiva comes nearest the edge of the cliff, there was a narrow opening or doorway not more than 15 inches wide. This was the only entrance to the interior, except through the roof, and it opens directly on the edge of the cliff, so that it is very difficult, although not impossible, to pass it. In front of the opening a little platform was built on the sloping edge of the cliff, as though entrance was had from the lower bench by artificial means, but it is more probable that this feature is all that remains of a chimney-like structure.

Above this kiva there was apparently a living room, the walls of which, where they still remain on the north and west sides, were approximately straight, but the corners were rounded. The roof was formed by the overhanging cliff and the interior walls were white-washed. The kiva walls were about 18 inches thick, but on the west side, in the small room between the kiva and the cliff, the masonry is much heavier, the lower part extending into the room a foot farther than the upper. This is caused by the wall of the second-story room above setting in toward the east or center of the kiva. This upper wall was supported by a beam, part of which is still in place. The small room behind is much blackened by smoke.

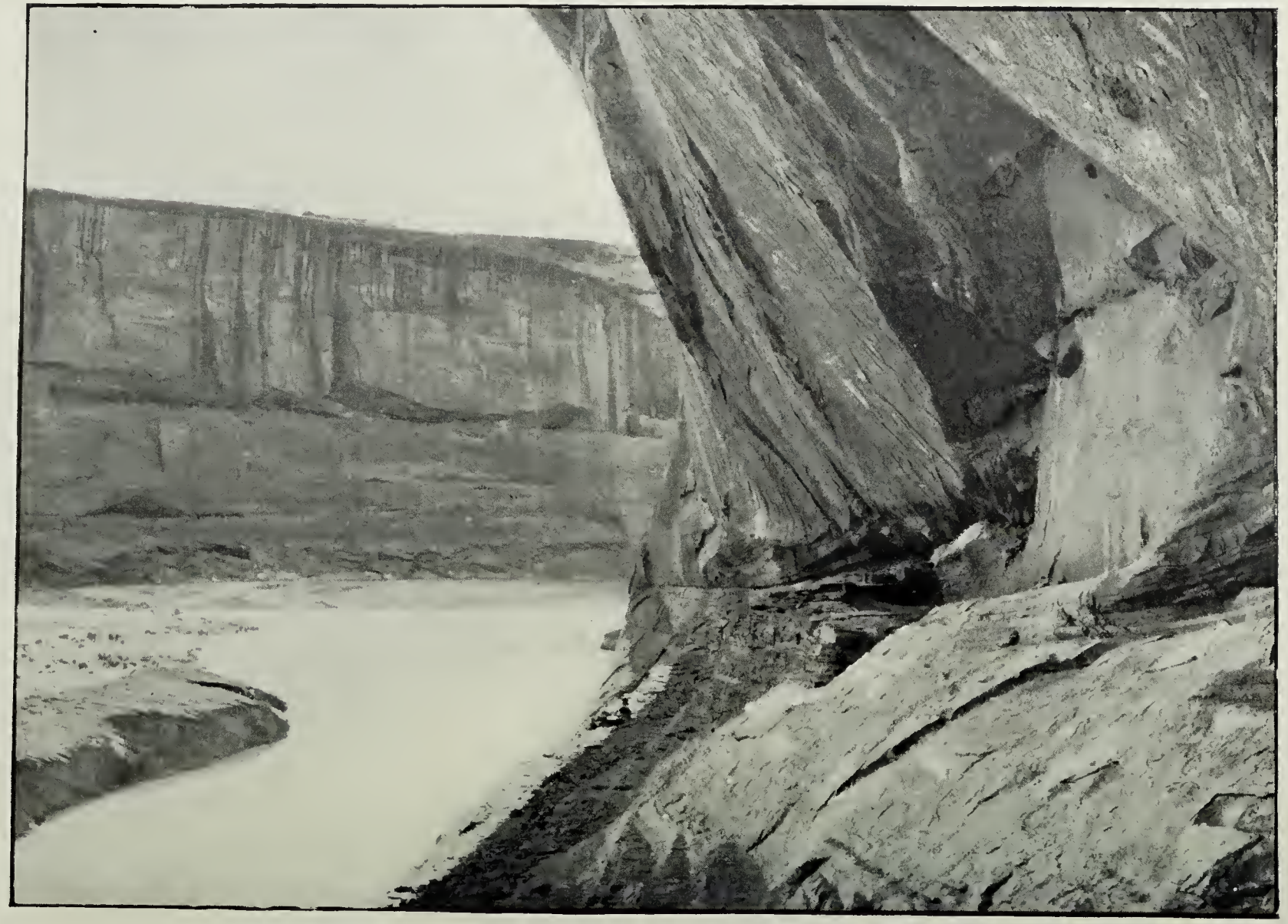
The exterior wall of the main kiva on the northwest side is very rough. On the northeast and southeast, however, it is covered by straight walls which are well finished. The western end of the north

wall is joined to the exterior circular wall of the kiva, at the point shown on the plan, by a short flying wall whose purpose is not clear. It extends to what may have been the roof of the kiva, but underneath it is open. The triangular cavity formed by it is too small to permit the passage of a person, and was available only from the second story.

The site of these ruins commands an extensive prospect, including several small areas of good bottom land, one of which lies directly in front of it; but the number of other ruins in the cove suggests that there was once a much larger area of bottom land here, and this suggestion is supported by the presence of several large cottonwood trees, now standing out in the midst of the sand, in the bed of the stream, where these trees never grow. Some of these trees are not yet entirely dead, indicating that the change in the bed of the stream was a recent one. Against the foot of the talus, just above the ruin, there is a narrow strip of bottom land, about 3 feet above the stream bed, and on it a single tree, still alive, but inclined at an angle. In the stream bed, above and below the ruin, there are large trees, of which only one or a few branches are still alive. The position of the cove with reference to the stream bed made the bottom lands here especially subject to erosion when the stream assumed its present channel and they were gradually worn away.

The western end of the ledge was occupied by a structure whose use at first sight is not apparent. The wall, as shown on the plan, is curved, very thick and heavy, and built partly over the sloping rock forming the back of the eave. The front wall is 3 feet thick, and its top, now level, is about 5 feet above a narrow bench in front of it. There is no doorway or other opening into it, and access into its interior was had over the steep sloping rock to the north by means of hand-holes in the rock. These are shown in plate L. The interior appears to have been plastered.

This structure measures 15 by 5 feet inside, there being no wall on the north, as the east wall merges into the sloping rock. The foot-holes in the rock, before referred to, are at this end, nearest the village, and appear to be in several series. The structure is so situated that the sun shines on it only a few hours each day, and it seems more than probable that it was a reservoir. The bed of the stream, the channel followed in low water, sweeps against the base of the cliff below this point, and by carrying water 20 feet it would be directly beneath and about 50 feet below it. Finally, the cliff wall above this point is decorated with pictographs of tadpoles and other water symbols in common use among the pueblos, and these do not occur elsewhere on this site. In the southwestern corner of the structure, near the bottom, there was an opening about 18 inches high, which was carefully filled up from the inside and plastered. This may have been an outlet by which the water was discharged when the reservoir was cleaned out. The wall has caved in slightly above it. The mud mortar used in building this structure and the other walls was necessarily brought from below.



RESERVOIR IN RUIN No. 10

About 25 feet east of the reservoir there are remains of a small single room, rectangular, with a circular addition, shown on the ground plan. The walls are well chinked and well constructed, the mud mortar being used when about the consistency of modeling clay. In front of this room, about 5 feet distant and on the edge of the sloping rock, a hole has been pecked into the solid rock of the ledge. This hole is 12 inches wide on top, slightly tapering, 10 inches deep on the upper side, and 4 inches on the lower. Twelve feet to the northeast there is a similar hole, and below it, distant 10 inches, another, and beyond this others, distributed generally along the foot of the sloping rock forming the back of the ledge, but sometimes farther out on the flat floor. Probably these holes mark the sites of upright posts supporting a drying scaffold or frame, the horizontal poles of which extended backward to the wall of the cliff.

FIG. 25—Oven-like structure in ruin No. 10.

Near the center of the ledge, at the point shown on the plan, there are some remains which strongly suggest the Mexican oven. The bed rock, which is here nearly flat, was removed to a depth of about 4 inches over a rectangular area measuring 4 feet north and south by 3½ feet. There were natural fissures in the rock on the north and west sides which left clean edges. The southern edge appears to have been smashed off with a rock. The eastern side required no dressing, as it was at a slightly lower level, and it was to reach this level that the rock was removed. In the rectangular space described there was a circular, dome-shape structure, about 3 feet in diameter, composed of mud and sticks, with a scant admixture of small stones. This is shown in figure 25, and in plan in figure 26. The walls were about 3 inches thick, and from their slope the structure could not have been over 3 feet high. The mud which composed the walls was held together by thin sticks or

branches, incorporated in it and curved with the wall—apparently some kind of a vine twisted together and incorporated bodily. On the edge of the rectangular space there is a drilled hole, 3 inches in diameter, shown in the illustration. Three feet to the south there is another, 6 inches in diameter.

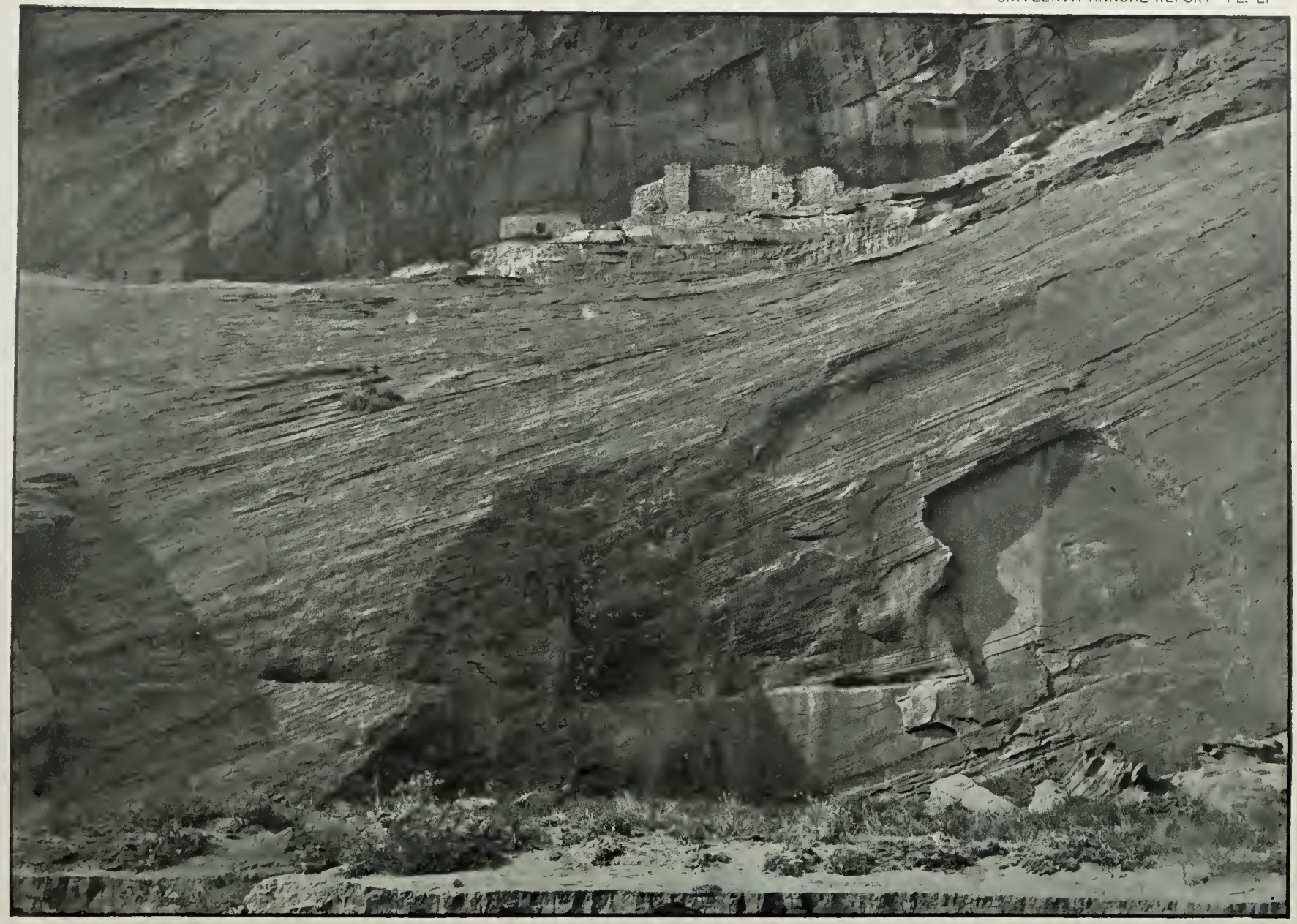
If this structure was a dome-shape oven, and it is difficult to imagine it anything else, its occurrence here is important. It is well known that the dome-shape oven, which is very common in all the pueblos, in some villages being numbered by hundreds, is not an aboriginal feature, but was borrowed outright from the Mexicans. If the structure above described was an oven, it is clear evidence of the occupancy of these ruins within the historic period—it might almost be said within the last century. No other structure of the kind was found in the canyon, however, and it should be stated that the ovens of the pueblos are as a rule rather larger in size than this and usually constructed of small stones and mud—sometimes of regular masonry plastered. There is a suggestion here, which is further borne out by the chimney-like structures to be discussed later, that only the idea of these structures was brought here, without detailed knowledge of how to carry it out—as if, for example, they were built by novices from description only.

FIG. 26—Plan of oven-like structure.

Figure 27 is the ground plan of a small village ruin situated at the mouth of Del Muerto at the point marked 16 on the map. The site, which is an excellent one, but rather difficult of access, overlooks the bottom land at the junction of the canyons and a long strip on the opposite side, together with a considerable area above. The approach is over smooth sandstone inclined at such an angle as to make it difficult to maintain a footing, but the ruin can be reached without artificial aid.

The village was not of large extent and contained but one kiva, but the walls were well constructed and the masonry throughout is exceptionally good. The exterior wall of the western rooms was constructed of small stones neatly laid. The eastern room of the two was built after the other, and entrance was had by an almost square opening 2 feet from the ground. To facilitate ingress, a notch was dug in the wall about 8 inches from the ground. There was no communication between the rooms, the western room being entered by a small doorway on the western side, about 8 inches from the ground, 3 feet high and 14 inches wide. There was no plastering in the interior of these rooms.

The kiva is 15 feet in diameter on the floor, and about 23 feet in its exterior diameter. The walls are 3 feet thick above the bench level and 4 feet



SMALL VILLAGE, RUIN No. 16, CANYON DE CHELLY

thick below it. The interior was plastered with a number of successive coats, probably four or five in all; but although the wall is still standing to a height of 4 feet or more above the bench, there are gaps on the eastern and western sides which render it impossible to say whether doorways were there or not. The eastern break exposes the western side of the inclosing wall, which is smoothly finished as though there were originally a recess here. There are rectangular inclosing walls on the east and south; the northern side was formed by the cliff against which the kiva rests, while on the west there are no traces of an inclosing wall. The triangular spaces formed by the inclosing walls on the northeast and southeast sides of the kiva were not filled up in the customary manner, but appear to have been preserved as storerooms. The southeastern space was connected with the kiva by a narrow doorway, shown in the plan, and another doorway, completely sealed, led from this space into the room adjoining on the east. The latter doorway had not been used for a long time prior to the abandonment of the ruin,

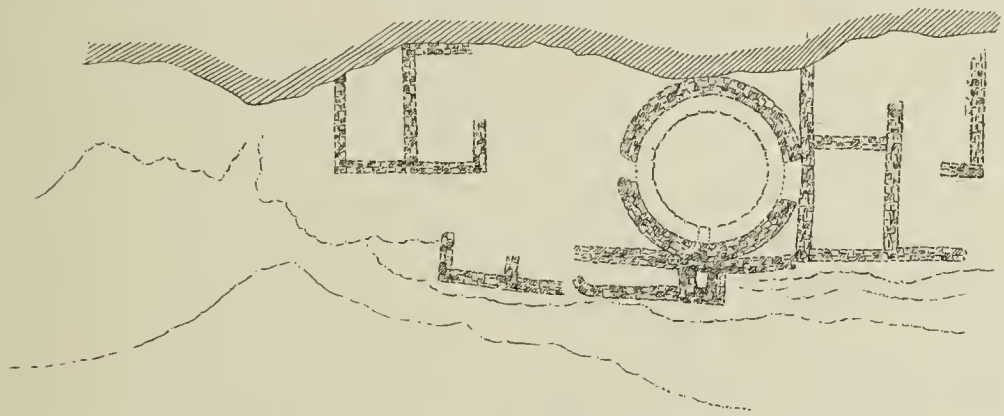


FIG. 27—Ground plan of a small village, ruin No. 16.

and its opening into the rectangular room was carefully concealed from that side by several successive coats of plaster.

On the south side of the kiva and outside the rectangular wall is a square buttress or chimney-like construction, 4 by 3 feet, inclosing a shaft 10 by 5 inches. This feature will be discussed in another place. It was added after the wall was completed, and embedded in it, about a foot from the ground, is a heavy beam about 5 inches in diameter. Plate LI, which shows the whole front of the village, will make this feature clear. The beam projects from the kiva wall at or under the floor level, and seems to have no reference to the shaft, which is, however, shouldered to accommodate it. Similar beams project from the walls to the east, about 8 inches above the bed rock.

In the room east of the kiva no doorway was found. The walls are still intact to a minimum height of 6 feet from the floor, except in the southeast corner, where they are 3 feet. The opening described, which occurs in the southwest corner of the room, was 4 feet from the floor; and in the southeast corner, where the wall is broken down, there now

are remains of one side of a similar opening on the same level. No stains of smoke are found on the exterior coat of plaster in this room, but the coats underneath were much blackened. The room north of the one described, and adjoining the kiva, was also without a doorway, unless it existed in the northeast corner, next the cliff, where no trace of walls now remains. The walls of this room, now 6 feet high, were plastered and show old smoke stains. The wall on the western side of the kiva is very rough, as though at one time another wall existed outside of it. This is shown in plate LII, which shows also the débris, consisting of ashes, sheep dung, and refuse, well compacted, upon which the wall rests.

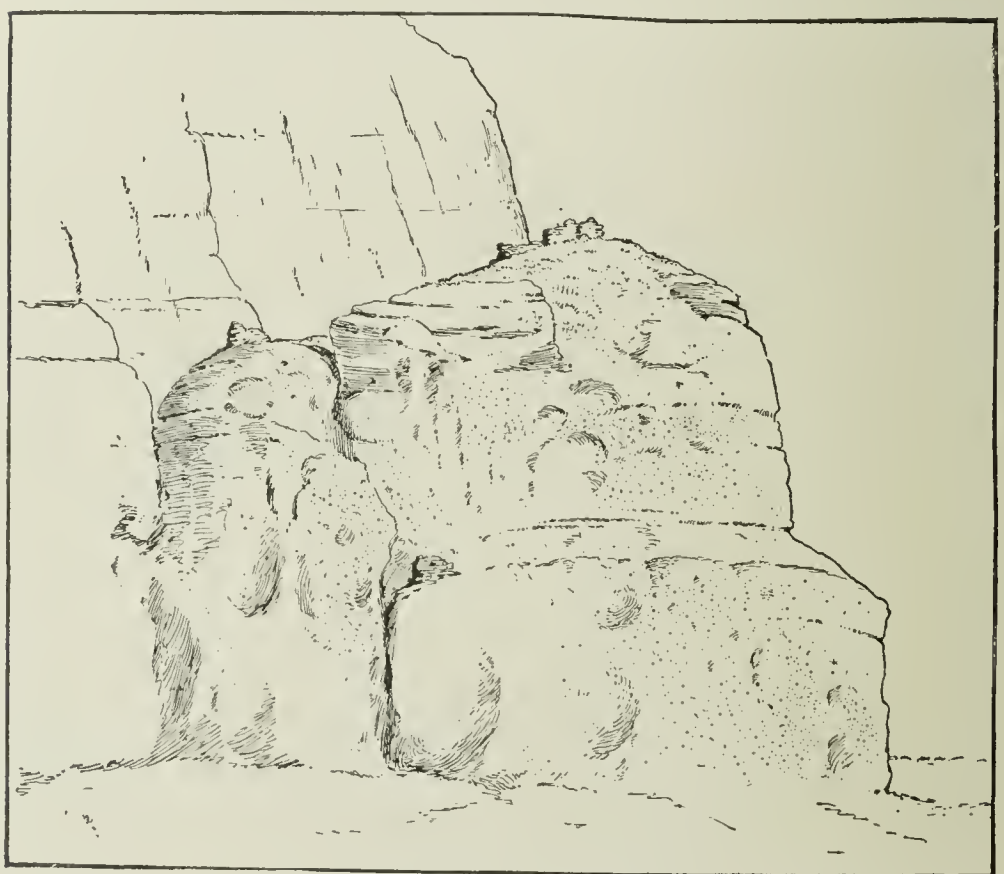


FIG. 28—Ruins on a large rock.

West of the kiva and on the extreme edge of the cliff are the remains of two small apartments, a trifle below the surface of the ledge and with a 3-foot wall on the south. These are too small for habitations, and were used probably for the storage of corn. About 100 feet west of the group described, on the same bench, there are remains of a large room, divided into two, and of quite rough construction. It contains several Navaho dead and may be of Navaho origin.

A type of site which is abundant in the San Juan country and is found in other regions, but is very rare in this, is shown in figure 28.

WALLS RESTING ON REFUSE IN RUIN No. 16

This example, which occurs in the upper part of Del Muerto, is the only one of its kind in the canyons. A large mass of rock, smoothed and rounded by atmospheric erosion, but still connected with the cliff at one point, juts out into the bottom, a large area of which is commanded by it. At three different levels there are remains of rooms, the group on the summit being the largest. It is doubtful whether any of these remains represent permanent villages, but it is possible that the uppermost one did. It is therefore included in this place.

At the point marked 49 on the map there is a ruin or group of ruins which presents some anomalous features. Figure 29 shows in detail the distribution of the remains. The rooms were located on narrow benches in the cliff, the principal part on a high, narrow bench, 40 or 50 feet above the top of the talus and over 300 feet above the canyon bottom. Access to the upper ledge from the top of the talus is exceedingly difficult, requiring a climb over almost vertical rock for 40 feet. Above the ledge there is massive sandstone, but below it for 100 feet or more there is an area of cross bedding, and the rock has an almost vertical cleavage,

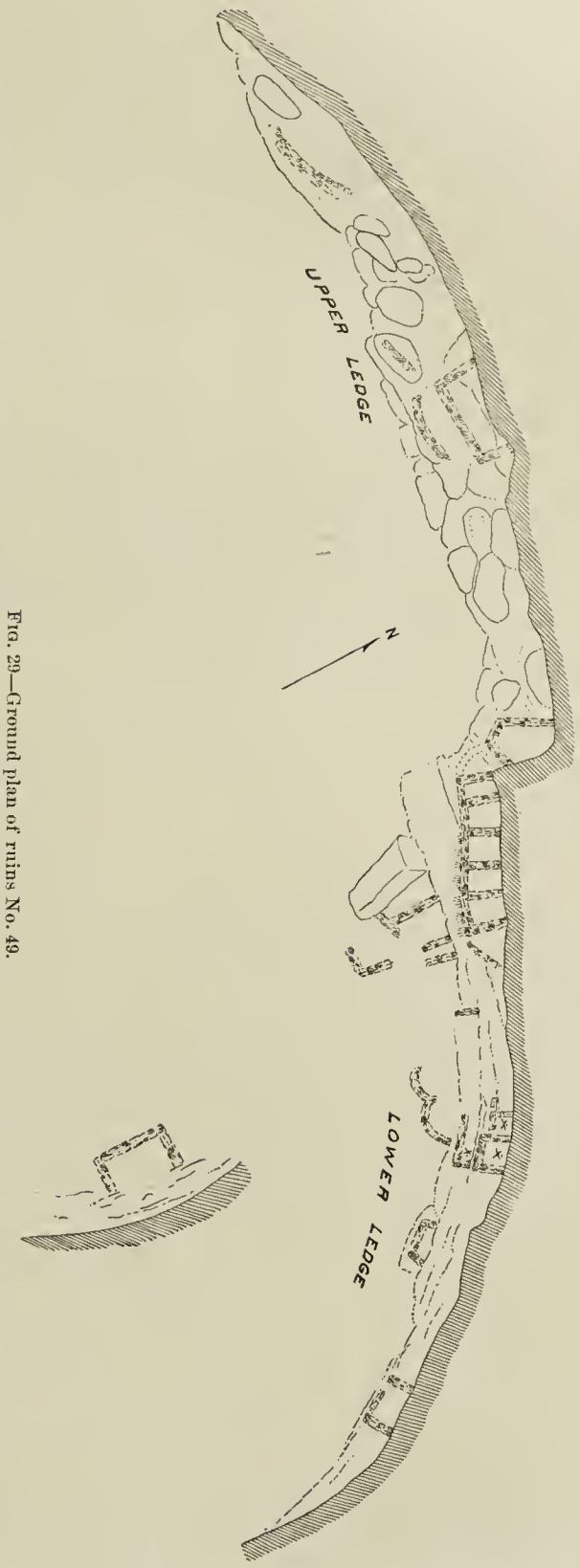


FIG. 29—Ground plan of ruins No. 49.

apparently standing upright in thin slabs 2 to 6 inches thick. Access was had by aid of the rough projections of the slabs, aided where necessary by hand and foot holes pecked in the rock. At several places little platforms of masonry have been built.

At the northern end of the upper ledge there are five small cells occupying its whole width, and whose front wall follows the winding ledge. The walls are about 5 feet high, and their tops bear the marks of the poles which carried the roof. There are no exterior openings, nor is there any evidence of a means of communication between the rooms; but in the second room from the south two stones project from the wall inside, near the southeastern corner, forming rude steps, doubtless to a trapdoor in the roof. These cells could hardly have been used as habitations. The floors are covered with many lumps of clay, which apparently formed part of the roof.

To the south of this cluster of cells there was a large room of irregular shape on a level about 8 feet higher. The remainder of the ledge, which is about on the same level as this large room, is almost covered with large bowlders, but at several points on it other remains of walls occur. The largest room of all was near its center. It was built against the cliff, which formed one of its sides, and measured about 16 by 6 feet. There are no evidences of any partitions or roof, the latter probably being formed by the overhanging rock. As the room was built partly on the sloping rock, the floor is very uneven. It could hardly have been used as a habitation, but may have been employed for the storage of water.

The southern end of the lower ledge merges into the head of the talus, the northern part drops down by a sharply sloping and in places an almost vertical wall of about 30 feet; thence it descends to the bottom by a long slope of bare rock, generally passable on foot. The lower ledge is about 50 feet above the upper. Upon it are scattered the remains of a few rooms of the same general character as those above, but smaller. Many of these have been utilized for modern Navaho burials, and perhaps some of them were constructed for that purpose. If these rooms were used as habitations, it must have been under very peculiar circumstances; moreover, the site is hardly suited for such a purpose, having the sunshine less than half of the day. In this respect it is anomalous.

At the southern end of the ledge there is a large angular bowlder, one edge of which rests against the cliff wall and is free from the ground. Under this the walls of a small room can be seen. The cliff formed one side of the room and the bowlder acted as a roof. On the extreme northern end of the ledge, 200 feet distant from the nearest room, there are remains of a structure standing alone. The masonry is much rougher than that of the other rooms, and, although the walls are now about 6 feet high, there is no evidence of any doorway or opening into the room.

On the surfaee of the sloping rock, at this point nearly flat, there are traces of a eircular kiva 18 or 20 feet in diameter. These traces occur at a point about midway between the southern and northern ends of the lower ledge and some 30 feet below it. The cliff walls, both of the lower and upper ledges, are eovered with pictographs in white, red, and yellow.

FIG. 30—Ruin on an almost inaccessible site.

The location and character of this site and the character of the remains suggest that most if not all of the rooms which ean now be traced were used for storage only. For this purpose the site is well adapted. But the remains of the eireular kiva at the foot of the lower

ledge show plainly that there were at one time some habitations here. Doubtless these were located on the smooth rock at the foot of the cliff, and the disappearance of all traces of walls may be due to the subsequent use of the material by the Navaho for the construction of burial cists, in which the site abounds. There still remains on the ground a fair amount of broken stone, suitable for building, but no lines of wall are now traceable.

Figure 30 shows one of the most inaccessible sites in the canyon. It occurs at the point marked 62 on the map, where there is a narrow ledge nearly 400 feet above the stream. The approach is over bare rock, sharply sloping, but passable at two points by an active man accustomed to climbing. Both of these points are near the western or left-hand end of the ruin; toward the right the rock becomes vertical. Immediately below this ruin there are the remains of a large settlement on a low spur near the stream, now much obliterated, and

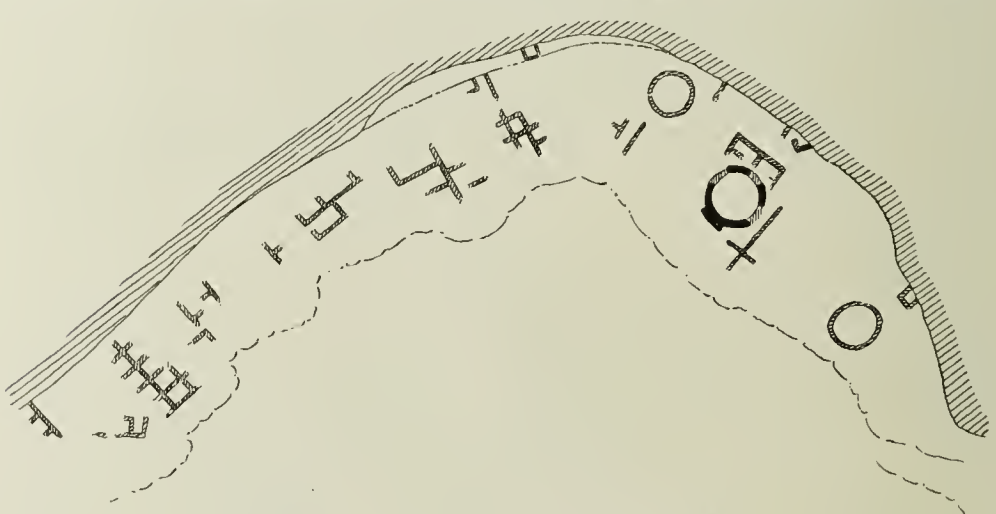


FIG. 31—Ground plan of a large ruin in Canyon del Muerto.

above and below it on suitable sites there were a number of small settlements which may have been connected with it.

There were a number of rooms scattered along the ledge which appear to have been used as habitations. The overhanging cliff is so close that in a number of cases it formed the roof of the room, and the whole site was an inconvenient and dangerous one. The rooms on the east rest on a large block which has split off from the wall since the walls were built, and now hangs apparently ready to drop at any moment.

At the time this site was inhabited access was had over the smooth rounded rock on the west. Here hand and foot holes have been pecked in the steep places, but as the rock is much exposed to atmospheric erosion these holes are now almost obliterated. After ascending the rock the village was entered through a doorway in a wall of exceptional thickness, shown on the left of the drawing. The room which was entered through this doorway appears to have been placed at this

point to command the entrance to the village. The wall is exceptionally heavy and was pierced with oblique loopholes commanding a narrow bench immediately in front of it. This appears to have been a purely defensive expedient, and as such is unique.

The site commands an extensive outlook over the canyon bottom, including several areas of cultivable land, and while it may have been occupied as a regular village, such occupancy could not have been long

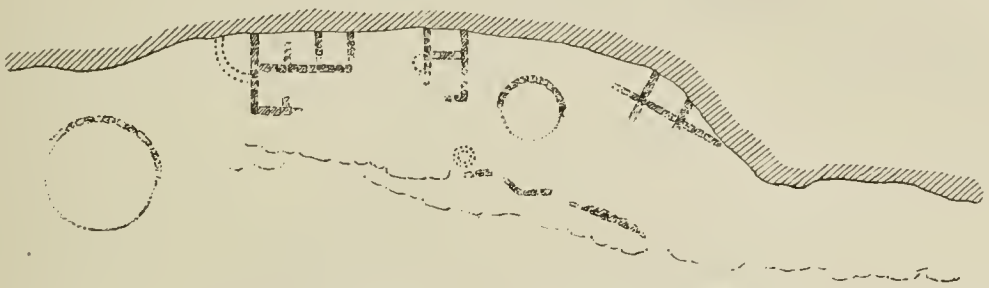


FIG. 32—Ground plan of a small ruin in Canyon del Muerto.

continued. Altogether the site and the character of the house remains are anomalous and doubtless resulted from anomalous conditions.

Figure 31 is a ground plan of a large ruin in Del Muerto. It occupied almost the whole available area of the ledge on which it is situated, and over 40 rooms can now be made out on the ground, in addition to 3 circular kivas. The settlement may have comprised between 80 and 100 rooms, which would accommodate 15 to 20 families. The size is very unusual, and the presence of but 3 kivas would indicate that the families were closely related. There are other examples of this character in the canyons, but not so large as the one illustrated.

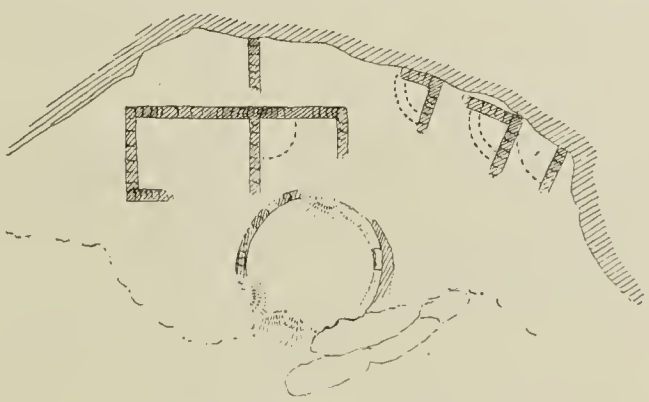


FIG. 33—Ground plan of a small ruin.

Figure 32 illustrates a type which is more common. Here we have the usual arrangement of rooms along the cliff, with a kiva in front of them. There were altogether not over 10 or 12 rooms, and they were probably occupied by one family. Figure 33 shows a kind rather more abundant than the last, and consisting like it of one circular kiva with rooms back of and between it and the cliff. Ruins of this type are generally well protected by an overhanging cliff. Figure 34 is another example, in

which only three rectangular rooms can be made out. The site here is almost covered with large bowlders. All these examples occur in Del Muerto.

Figure 35 is a ground plan of a small ruin which occurs at the point marked 36 on the map. It is situated in a shallow cove at the head of the talus, 200 or 300 feet above the bottom, and is of comparatively

FIG. 34—Plan of a ruin of three rooms.

easy access. There is but a small amount of cultivable bottom land immediately below it, but it commands extensive areas on the opposite side of the canyon and in the lower part of a branch on that side. There are but few remains of rooms other than parts of two kivas, but there is no question that there was at one time a considerable number here. Both kivas had interior benches, and were of small size, plastered

FIG. 35—Ground plan of a small ruin, with two kivas.

in the interior. The masonry is fair to good. On the highest point of the bowlder shown on the right of the plan there is a fragment of compacted sheep dung and soil, which is now 6 feet above the ground. It is all that remains of a layer of some thickness which must have been deposited when the surface was filled up to or nearly to the top of the rock. Possibly there was a wall outside and only the intermediate space was filled.

Figure 36 is the ground plan of a somewhat similar ruin which occurs at the point marked 44 on the map. It is situated on the top of the talus, against the cliff, and commands a fine outlook over the cultivable lands in the cove below it and on the canyon bottom proper. There are but few wall remains, but two kivas can still be made out. There is no ledge here, and the walls were built on loose débris of rocks and talus.

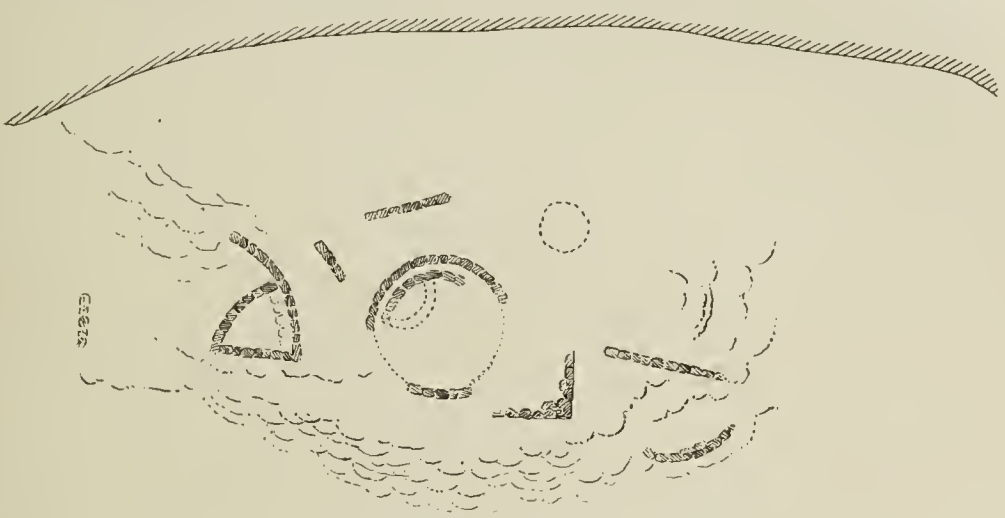


FIG. 36—Ground plan of a small ruin, No. 44.

The builders had some trouble in holding the walls in place, and only partly succeeded in doing so. About one-half of the principal kiva is standing, showing masonry composed of exceptionally large stones, roughly chinked. The other, or western kiva, was similarly constructed, and both had interior benches. The front of the western kiva fell out, the builders being unable to tie it or to hold it in place on its

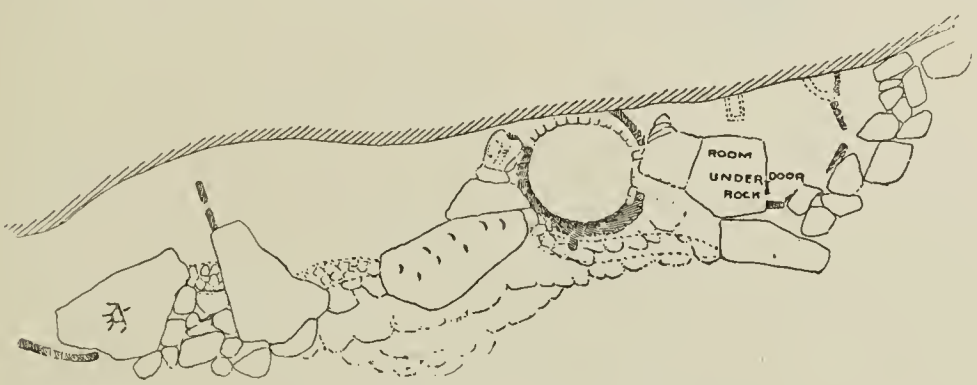


FIG. 37—Ground plan of a ruin on a rocky site.

loose foundation, and other walls were constructed inside of it, as shown on the plan. There were other walls outside the main kiva, apparently rectangular inclosing walls. This example is interesting because the masonry was constructed on a foundation of loose débris, not on bed rock, and the knowledge possessed by the builders was not sufficient to enable them to overcome the natural difficulties of the site.

Although ultimately the village had to be abandoned as a failure, it was certainly occupied for some years, and this occupancy suggests that there was some strong objection to the lower part of the canyon. It illustrates, moreover, the importance which was attached to a command or outlook over extensive cultivable areas, as to obtain such an outlook the builders were content to occupy even such an unsuitable site as the one described.

Figure 37 shows a small ruin similar to those described, but located on a site almost covered with large bowlders. The principal structure now remaining is a circular kiva, which, contrary to the usual plan, was placed close up against the cliff; possibly the cliff formed part of the back wall. Large bowlders so closely hemmed in the structure that there was neither space nor necessity for an inclosing wall. The kiva was benched for about half of its circumference.

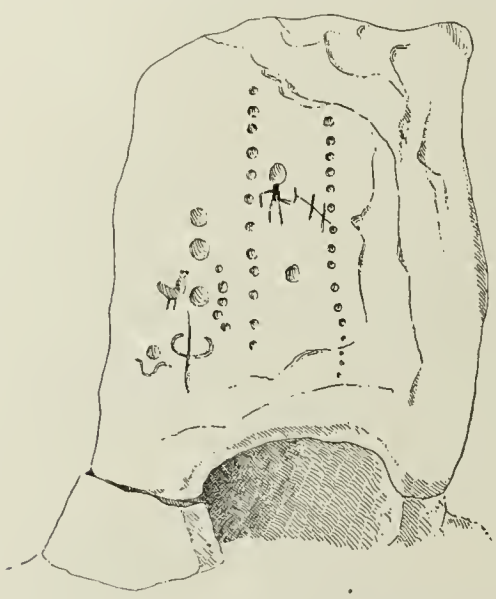


FIG. 38—Rock with cups and petroglyphs.

Under the large bowlder to the right of the kiva a complete room had been built, with a doorway of the usual type through the front wall. Scattered remnants of other walls may be seen here and there, but none show well-defined rooms. Petroglyphs are quite numerous, and one small bowlder to the left of and next to the kiva is covered with cups, dots, and carvings. It is shown in figure 38.

Figure 39 shows a ruin where the site was not so restricted. One well-defined room and two kivas still remain, and there are traces of other chambers. The main kiva formed part of a compact little group of rooms, of which it occupied the front, and appears to have been inclosed by a curved wall of rough construction. A curved inclosing wall is an anomalous feature, and it is not at all certain that it occurs here, as the wall is so much broken down that its lines can not now be clearly made out. Excavation would doubtless determine this, as the whole site has been much filled up with sand and loose earth.

The second kiva, which was about the same size as the first, was situated some little distance from the other, and on the outer edge of the little platform or bench on which the settlement was located. It still shows about half of its wall. The rectangular room near the main kiva still stands to a height of 3 and 4 feet. The wall nearest the kiva is pierced by a number of small openings, and by a neatly finished double-notched doorway, which is illustrated in another place (figure 67).

The whole front of the site has been filled up to a probable depth of several feet, and a number of Navaho burials have been made on it.

These are shown on the plan by shaded spots. Owing to the soft ground underneath, it was easier to excavate a hole and wall it up than to construct the regular surface cist, and the former plan was followed.

Although many of the sites are covered with bowlders and blocks of stone fallen from above, which often occur among and even over walls, close inspection generally shows that the walls were constructed after the rocks fell. There are two instances, however, which are doubtful, and in one (shown in figure 40) it appears that large blocks of rock have fallen since the walls were constructed. Such falls of rock are not uncommon now in the fall and winter months, when frost and seepage from the melting snow sometimes split off huge fragments.

FIG 39—Ground plan of a ruin in Canyon de Chelly.

The site mentioned occurs at the point marked 47 on the map. It is in a cove under a mass of rock which juts out from the cliff, and is about 30 feet above the bottom, on the edge of a slope of loose rock which extends some distance above it. At the top of the talus, over 200 feet above, there is another ruin, which was probably only an outlook, as no trace of a kiva can be found, and it is possible that the lower site was connected with and formed part of the upper one. The lower site contained a circular kiva, only a small portion of which now remains, and the ground is covered with blocks of rock which must have fallen since the walls were built. They appear to have fallen quite recently. It can still be seen that the kiva had an interior bench, and that there was a room, or perhaps rooms, between it and the back of the cove; but beyond this nothing can now be made out.

There are many favorable sites in the branch canyons, but not many of them are occupied, possibly because in the upper parts of these canyons the bottom land is of small area and is sometimes rough, being composed of numerous small hillocks. The flat bottom lands of the canyon proper are much easier to cultivate, but the sites in the side canyons offered much better facilities for defense. Figure 41 shows the plan of a ruin which occurs at the point marked 69 on the map, on the western side of a branch canyon through which passes the trail to Fort Defiance. It is situated in a shallow cove at the top of the talus and overlooks an extensive area of fine bottom land below it. At the eastern end there is a single room about 10 feet long; its front wall extends up to the overhanging rock, which forms the roof of the room. A small cist has been built against it on the west.

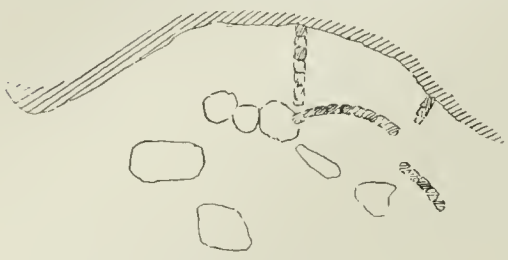


FIG. 40—Site showing recent fall of rock.

About 60 feet west, on the same ledge, there are remains of other rooms which rested probably on the talus. Several rooms can be made

FIG. 41—Ruin No. 69, in a branch canyon.

out, but only one shows standing walls. This is on the western end, and the walls are now about 5 feet high. Four feet from the top of the wall there is a clear line of demarcation extending horizontally across it. Below this line the masonry consists of large flat slabs of rock laid in mud mortar, which was used nearly dry and stuffed into the cracks to some extent. Above the line the stones were carefully selected and the work was well done, the whole being finished by a thin coat of plaster. There is no opening in the lower part, but in the upper part there is a neatly finished doorway 3 feet high and slightly tapering. The bottom of this opening extends 2 inches below the line, and the lintel is composed of a large slab of stone a trifle wider than the thickness of the wall, but fitted flush on the outside.

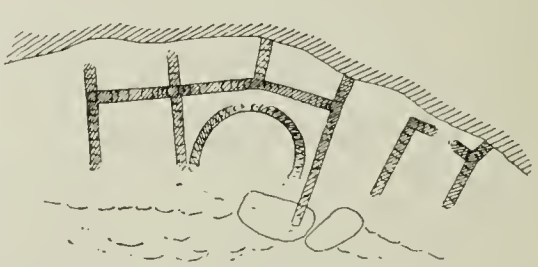


FIG. 42—Ground plan of a small ruin in Canyon del Muerto.

On a bench about 100 feet higher than the ruin described there are two small rooms, extending up to the overhanging rock above them. These rooms, which may be of Navaho origin, were reached by means of a narrow ledge extending

from the top of a slope of loose rock and débris about 300 yards to the southward, or up the canyon.

Figure 42 is a ground plan of a small ruin in Del Muerto in which the usual preponderance of rectangular rooms is illustrated. The site was restricted, but there is an apparent attempt to carry out the usual arrangement of a row of rooms against the cliff, with a kiva in front.

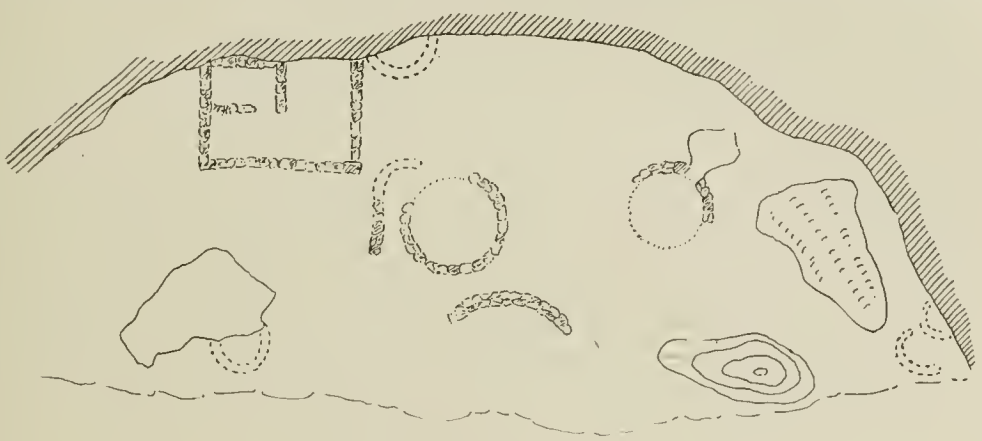


FIG. 43—Ground plan of a small ruin.

Probably only three of the rooms shown were used as habitations. The plan of the kiva, which occurs in the center, was somewhat marred by a large bowlder, which must have projected into it, but apparently no attempt was made to dress off the projecting point.

Figure 43 is the plan of a ruin located on a more open site. Only a few walls now remain, but there is no doubt that at one time more of

FIG. 44—Plan of a ruin with curved inclosing wall.

the site was covered than now appears. There are remains of two, and perhaps of three, circular kivas.

Figure 44 shows a ruin in which the plan is somewhat more elaborated. There are remains of several well-defined rooms, and two kivas are still fairly well preserved. The ledge is narrow and the rooms are stretched along it, with kivas at either end. That on the east was

benched nearly all around its interior, and the outside inclosing wall, on the east, apparently follows the curve. An example in which this feature occurs has been mentioned above (page 138). It is very rare, but in this case the evidence is clearer than in the one previously described. The western kiva, somewhat smaller than the other, was also benched, and had an exterior shaft, like those mentioned above and later described at length.

Figure 45 is a plan of a small ruin of the same type, which occurs in the middle region of De Chelly. It occupies the site marked 34 on the map, and is situated in a niche in a deep cove, where the outlook is almost completely obscured by a large sand dune in front of it. It comprised one circular kiva and four rectangular rooms, but, contrary to the usual result, the latter are fairly well preserved, while the former is almost completely obliterated. This may be due to the use of the rectangular rooms as sites for Navaho burial cists, of which there are no fewer than six here, and possibly the kiva walls furnished the necessary building material for the construction of the cists. The old masonry is of good quality, the outside wall being

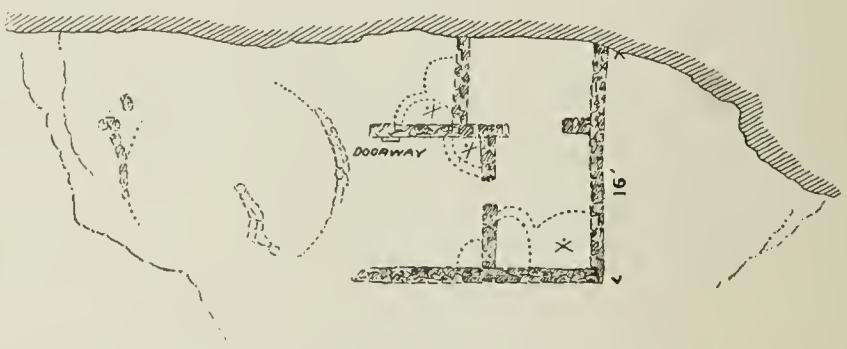


FIG. 45—Ground plan of ruin No. 34.

formed of selected stones of medium size, well laid and carefully chinked. Most of the walls were plastered inside. In a cleft in the rock to the right of this ruin there is a kind of eave, with foot-holes leading up the rock to it, and quite difficult of access. It formerly may have been used for storage, but at present contains only some remains of Navaho burials.

IV—CLIFF OUTLOOKS OR FARMING SHELTERS

Ruins comprised in the class of cliff outlooks, or farming shelters, are by far the most numerous in the canyon. They were located on various kinds of sites, but always with reference to some area of cultivable land which they overlooked, and seldom, if ever, was the site selected under the influence of the defensive motive. It is not to be understood that such motive was wholly absent; it may have been present in some cases, but the dominating motive was always convenience to some adjacent area of cultivable land.

The separation of this class of ruins from the preceding village ruins, while clear and definite enough in the main, is far from absolute. The sole criterion we have is the presence or absence of the kiva, as the sites occupied are essentially the same; but this test is in a general way sufficient. It is possible that in certain cases the kiva is so far obliterated as to be no longer distinguishable, but the number of cases in which this might have occurred is comparatively small. The kivas, as a rule, were more solidly constructed than the other rooms, and, as the preceding ground plans show, sometimes survived when the rectangular rooms connected with them have entirely disappeared.

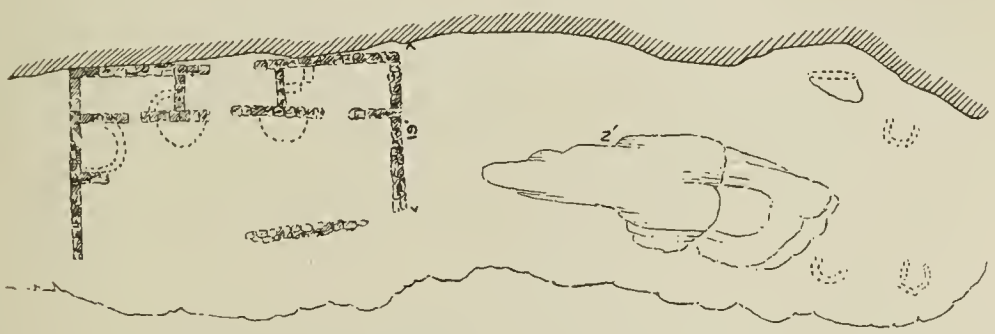


FIG. 46—Ground plan of cliff outlook No. 35.

Figure 46 is the plan of an outlook in the same cove as the last example of village ruin illustrated, and only 200 or 300 yards south of it. It may have been connected with that ruin, but could not in itself have been a village, as there are no traces of a kiva on the site, and hardly room enough for one on the bench proper. At the extreme northern end there are traces of walls on the rocks at a lower level.

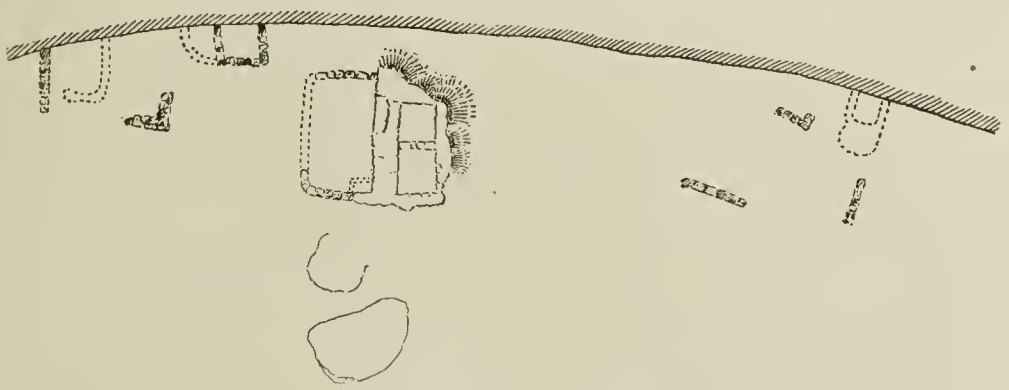


FIG. 47—Plan of a cliff outlook.

The walls which were at right angles to the cliff were not carried back to it after the usual manner, but stopped about 3 feet from it, and the rooms were closed by a back wall running parallel to the cliff, and about 3 feet from it. This wall rises to a height of about 4 feet before it meets the overhanging cliff, and consequently there is a long narrow passageway, about 3 feet high and 3 feet wide on the bottom, between it and the cliff. A small man might wriggle through, but with difficulty.

The ruin commands a fine outlook over the cove. The masonry is good, being composed of selected stone well chinked with small spalls, and sometimes with bits of clay pressed in with the fingers.

Figure 47 shows a ruin located at the point marked 37 on the map. There is a high slope of talus here, the top of which is flat and of considerable area.

The ruin is invisible from below in its present condition, but the site commands a fine outlook over several considerable areas of bottom land. The walls are now much obliterated and worked over by the Navaho, but the remains are scattered over quite an extensive area and may have been at one time an extensive settlement; however, no traces of a kiva can now be seen. Marks on the cliff show that some of the houses had been three stories high. Some places on the cliff, which were apparently back-walls of rooms, were plastered and coated with white, and there are many pictographs on the rock. The masonry is of fair quality, but the stones were laid with more mortar than usual.

Figure 48 is a ground plan of a ruin which occurs at the point marked 46 on the map. It is situated in a cove in the rock at the top of

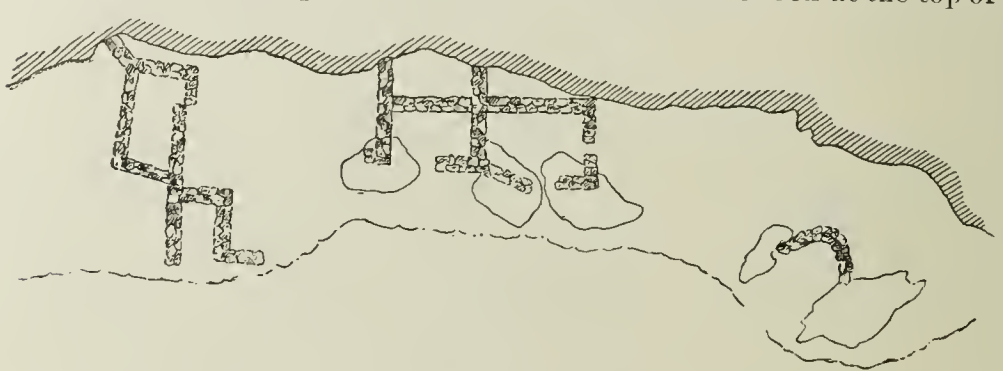


FIG. 48—Plan of cliff ruin No. 46.

the talus, 300 or 400 feet above the bottom, and immediately above the rectangular single room described and illustrated on page 151. It commands an extensive outlook over the bottom lands on both sides of the canyon and above. The cove is about 40 feet deep, and, though so high up, has been used as a sheep close, and doubtless some of the walls have been covered up. Four rooms are still standing in two little clusters of two rooms each. The walls of the rooms on the west are composed of large stones laid in plenty of mud mortar and plastered inside and out; those of the eastern portion were built of small stones, chinked but not plastered. One of the rooms is blackened by smoke in the corner only, as though there had been some chimney structure here, which subsequently had fallen away. The cliff walls back of the eastern part are heavily smoke-blackened; back of the western portion there are no stains. There is now no trace of a circular kiva, but there is a heavy deposit of sheep dung on the ground which might cover up such traces if they existed. This site commands one of the best outlooks in the canyon, but access, while not very difficult, is inconvenient on account of the great height above the bottom.

Figure 49 shows a common type of ruin in this class. The original structure appears to have contained one or two good rooms, which by subsequent additions have been divided into several. These later additions may have been made by the Navaho, who used the building material on the ground; at any rate the structure is now merely a cluster of storage cists.

One of the most extensive ruins of the cliff-outlook type situated in Canyon del Muerto is shown in figure 50. The plan shows at least eight

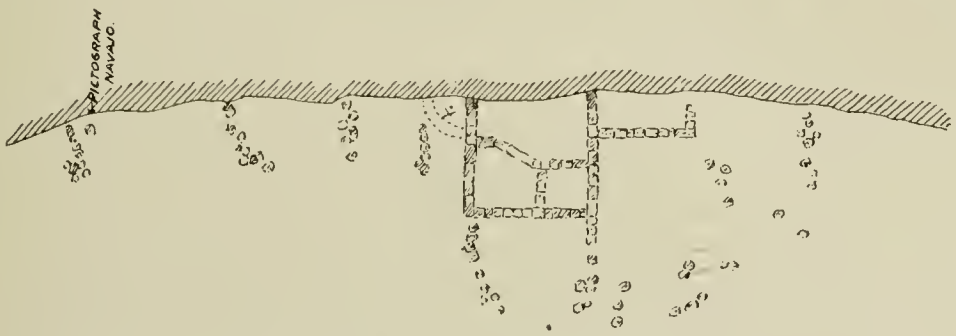


FIG. 49—Plan of cliff room with partitions.

rooms stretched along the cliff at the top of the talus. Figure 51 shows five rooms arranged in a cluster. One of these is still complete, the walls extending to the overhanging rock above which formed the roof. It will be noticed that the front room was set back far enough to allow access to the central room through a doorway in the corner. This was a convenience, rather than a necessity, for many of the rooms in ruins of this class were entered only through other rooms or through the roof, and a direct opening to the outer air was not considered a necessity;

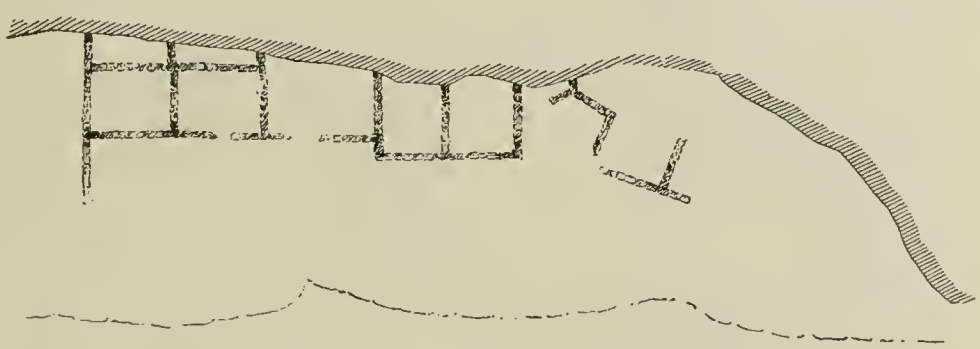


FIG. 50—Plan of a large cliff outlook in Canyon del Muerto.

probably because these rooms in the cliff, which have been termed outlooks, were not in any sense watch towers, but rather places of abode during the harvest season, where the workers in the field lived when not actually employed in labor, and where the fields under cultivation could always be kept in view—an arrangement quite as necessary and quite as extensively practiced now as it was formerly.

Figure 52 shows a cluster of rooms in the little canyon called Tseonitsosi. This is another Casa Blanca, or White House, and, oddly enough,

it resembles its namesake in De Chelly, not only in the coat of whitewash applied to the front of the main room, but in having a subordinate room to the left, over which the wash extends, and in the character of the site it occupies. The principal part of the structure was built in a cave, 18 or 20 feet from the ground, across the front of which walls extended as in the other Casa Blanca, and, like that ruin, there are also some ruins at the foot of the cliff, on the flat. Figure 53 is a ground plan. The resemblance to the other Casa Blanca, however, goes no further. The ruin here illustrated represents a very small settlement, hardly more than half a dozen rooms in all, and there is no trace of a circular kiva, or other evidence of permanent habitation. It is possible that the space between the edge of the floor of the cave above and the whitened house back of it was occupied by some sort of structure, but no evidence now remains which would warrant such a hypothesis, except that the door of the white house is now about 4 feet above the ground. The cave is only 40 feet long and a little over 10 feet deep, and there is not room on the floor for more than three or four rooms, in addition to

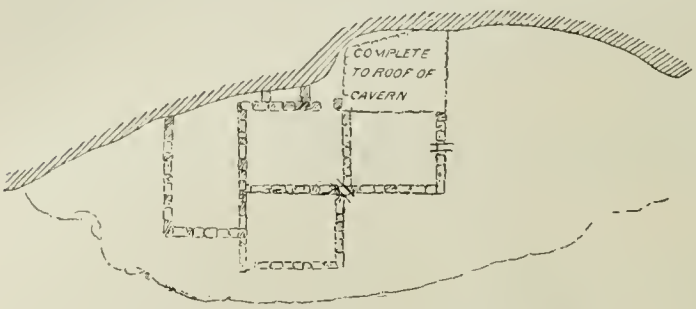


FIG. 51—Plan of a cluster of rooms in Canyon del Muerto.

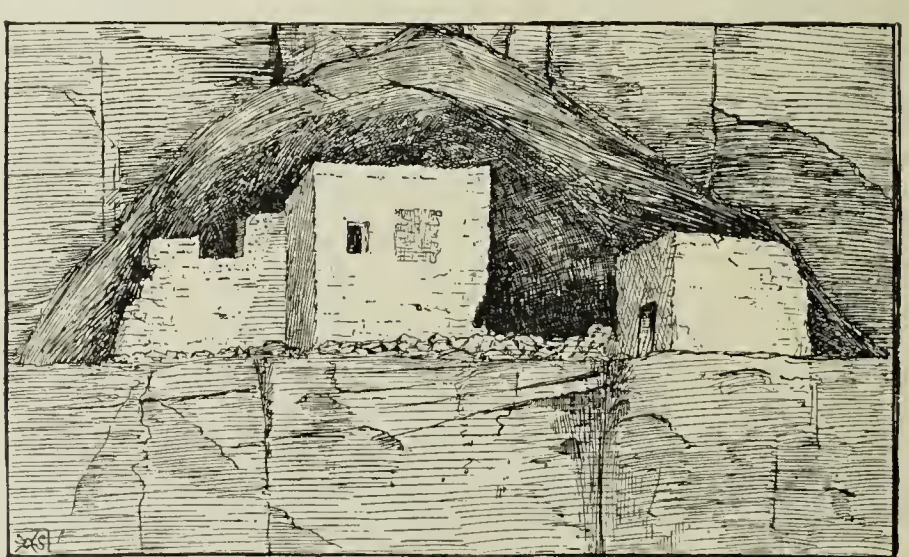


FIG. 52—White House ruin in Tsconitsosi canyon.

those shown on the plan. The room on the right still preserves its roof intact, showing the typical pueblo roof construction. It has a well-preserved doorway, and three other openings may be seen in the main room.

Apparently some effort at ornamentation was made here. The whitewash was not applied to the fronts of the two back rooms so as to cover

all of them, but in a broad belt, leaving the natural yellowish-gray color of the plastering in a narrow band above and a broad band below it. Moreover, the principal opening of the larger room was specially treated; in the application of the whitewash a narrow border or frame of the natural color was left surrounding it. The attempt to apply deco-

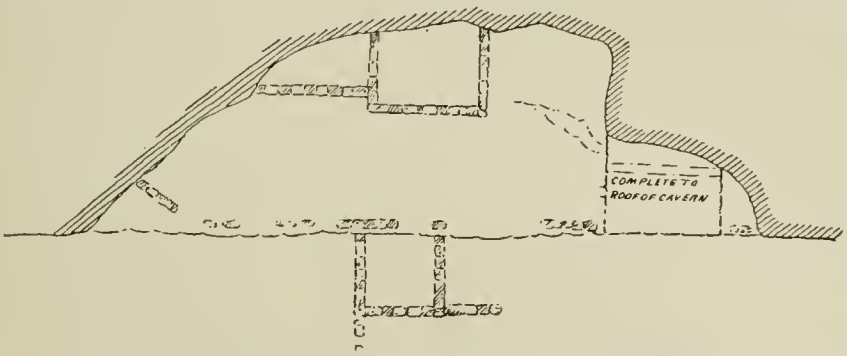


FIG. 53—Ground plan of a ruin in Tseonitsosi canyon.

ration not utilitarian in character is rare among the ruins here. It implies either a late period in the occupancy of this region, or an occupancy of the site by a people who had practiced this method of house-building longer or under more favorable conditions than the others.

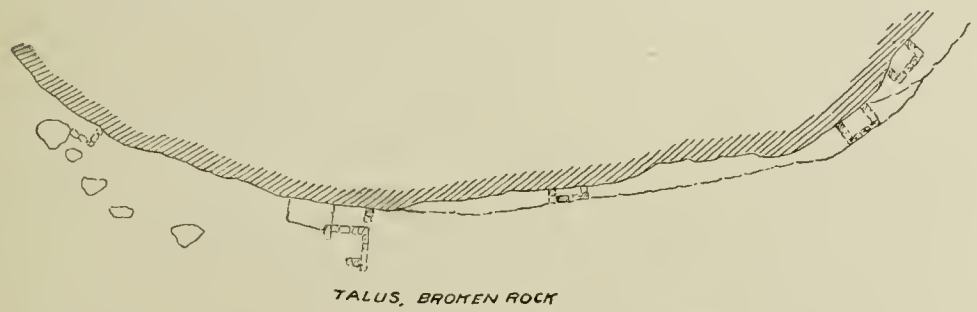


FIG. 54—Plan of rooms against a convex cliff.

Figure 54 shows an arrangement of rooms along a narrow ledge at the top of the talus, where the cliff wall is not coved or concave, but convex. Some of these little rooms may have been used only for storage, but others were undoubtedly habitations. Figure 55 shows an

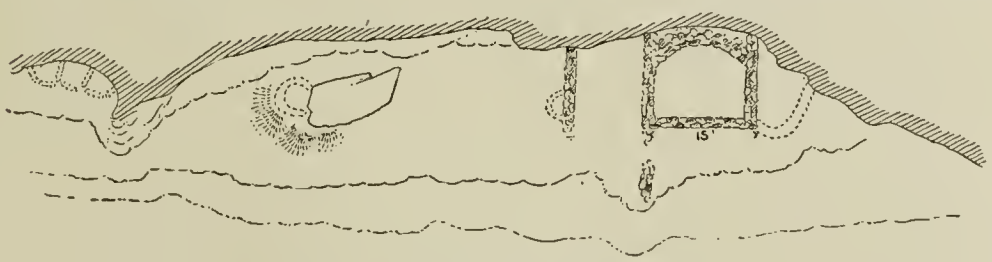


FIG. 55—Small ruin with curved wall.

example in which the back wall is curved, as though it was either built over an old kiva or an attempt was made to convert a rectangular room into a kiva. There were originally three rooms in the cluster, only one of which remains, but that one is of unusual size, measuring about 15

by 10 feet. If the room was used solely as a habitation, there was no necessity for the back wall, as the side walls continue back to the cliff. Including the little cove on the left, there are seven Navaho burial places on this site.

Plate LIII shows an outlook in the lower part of De Chelly, at the point marked 6 on the map. The lower part of the cliff here flares out slightly, forming a sharp slope; where it meets the vertical rock there is a small bench on which the ruin is situated. It is apparently inaccessible, but close examination shows a long series of hand and foot holes extending up a cleft in the rock, and forming an easy ascent. The site commands a good outlook over the bottom lands.

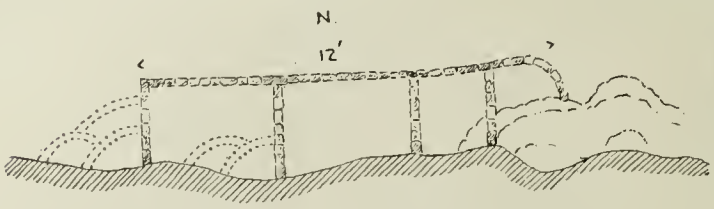


FIG. 56—Ground plan of a cliff outlook.

The ruin consists of three rectangular rooms arranged side by side against the cliff, and a kind of curved addition on the east. Figure 56 is a ground plan. The walls are still standing from a foot to 4 feet high, and produce the impression of being unfinished; although carefully chinked, they were neither plastered nor rubbed down. The two western rooms were built first, and the eastern wall extends through the front. East of these rooms there is a small rectangular chamber, and east of this again a low curved wall forming a little chamber or cist of irregular form (not shown in the plan). The front wall was extended beyond this and brought in again to the cliff on a curve, forming another small cist of irregular shape. This and the little chamber west of it were doubtless used for storage. They resemble in plan Navaho cists, but the masonry, which is exactly like the other walls here, will not permit the hypothesis of Navaho construction. Except for some slight traces in the northwest corner of the west room, there are no smoke stains about, nor are there any pictographs on the cliff walls. The western room was pierced by a window opening which was subsequently filled up, possibly by the Navaho, who have five burial cists here.

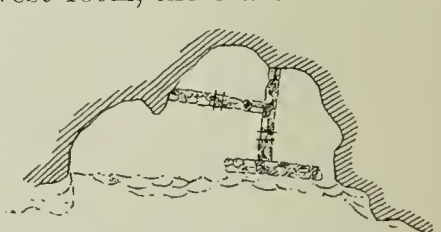


FIG. 57—Plan of cliff outlook No. 14, in Canyon de Chelly.

Figure 57 is the plan of a small outlook which occurs at the point marked 14 on the map. Opposite the mouth of Del Muerto there is an elevated rocky area of considerable extent, perhaps 50 feet above the bottom, but shelving off around the edges. Near the cliff this is covered by sand dunes and piles of broken rock; farther out there is a more level area covered thinly with sand and soil, and here there is a large ruin of the old obliterated type already described (page 93).

CLIFF OUTLOOK IN LOWER CANYON DE CHELLY

Near the edges the rock becomes bare again, and is 20 to 30 feet high, descending sheer or with an overhang to the bottoms or to the stream bed. On the western side, facing north, the ruin illustrated occurs. It is a mere cubby hole, and was evidently located for the area of cultivable land which lies before it, and which it almost completely commands. The cavity is about 12 feet above the ground and appears to have been divided by cross walls into three rooms, two of which were quite small. The back room was small, dark, and not large enough to contain a human body unless it was carefully packed in, and at various points along the back wall there are seeps of water. The interior of the little room was very wet and moldy at the time when it was examined, in winter, but in the summer time is probably dry enough.

FIG. 58—Ground plan of outlooks in a cleft.

The masonry is fair and the surface is finished with plaster. The open space in front of the small back room and the outer wall of the room itself are much blackened by smoke, as though the inhabitant lived here and used the small room only to store his utensils and implements. A small room on the east must have been used for a similar purpose. Both of these rooms were entered through narrow doorways opening on the principal space. The site is an ideal one for a lookout, but not well suited for a habitation. Plate LIV shows its character.

Cliff outlooks are often found on sites whose restricted areas preclude all possibility that they formed parts of larger settlements since obliterated. The ruin just described is an example. Another instance

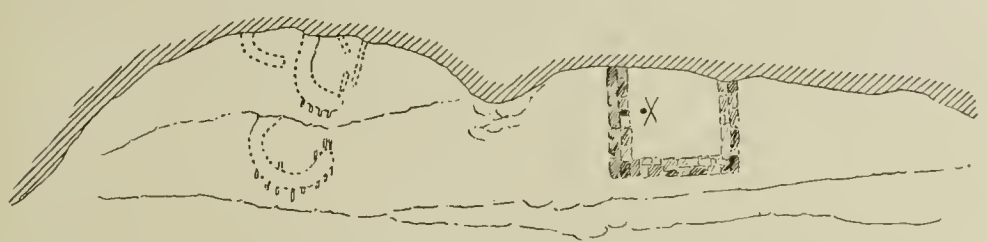


FIG. 59—Plan of a single-room outlook.

which occurs in Del Muerto is shown in figure 58. Here a deep cleft in the rock was partly occupied by two or three rooms. There was room for more, but apparently no more were built. There was not room, however, for even a small village. There are several other examples in the canyon almost identical with these, but this type is not nearly so abundant as the succeeding. Figure 59 is a plan of a

ruin near the mouth of Del Muerto. It was a single room, situated on a ledge perhaps 30 or 40 feet above the bottom land which it overlooked and of easy access. This is the most common type of outlook or cliff ruin, and it might almost be said that they number hundreds, sometimes consisting of one room alone, sometimes of two or even three. The general appearance of these outlooks is shown in figure 60, which shows an example containing three rooms.

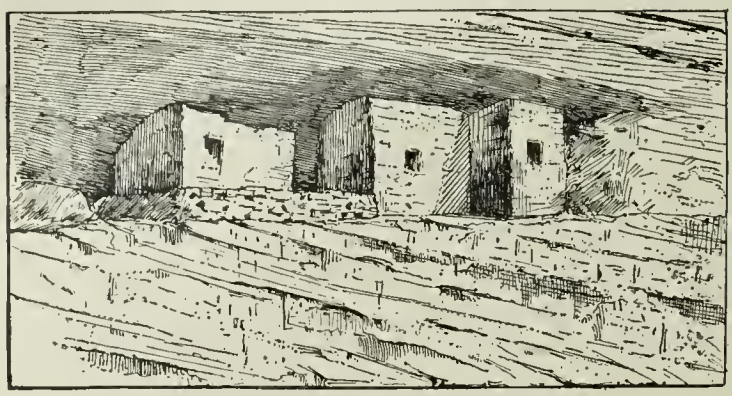


FIG. 60—Three-room outlook in Canyon del Muerto.

Figure 61 is a ground plan of an example containing two rooms, which occurs below the large ruin described before (No. 31, page 119), and figure 62 shows an example with one room, obscured and built over with Navaho cists. This site is located in the upper part of the canyon, on top of the talus, about 100 feet above the stream, and commands an outlook over several areas of bottom land on both sides. The walls are built about 10 feet high, and are composed of medium-size stones laid in courses and carefully chinked with small spalls. The southwestern corner of the room is broken down, but the eastern wall is still standing, and shows a well-finished opening on that side. There are several Navaho burial cists on this site.

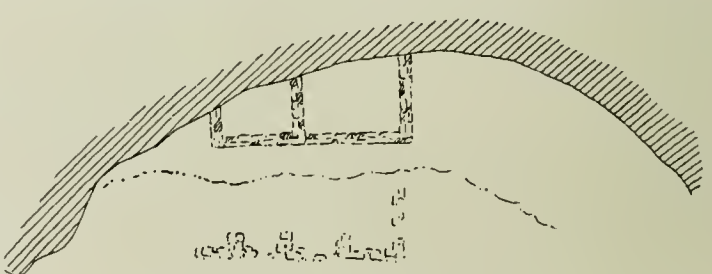


FIG. 61—Plan of a two-room outlook.

Figure 63 is the plan of a type of ruin which is rather anomalous in

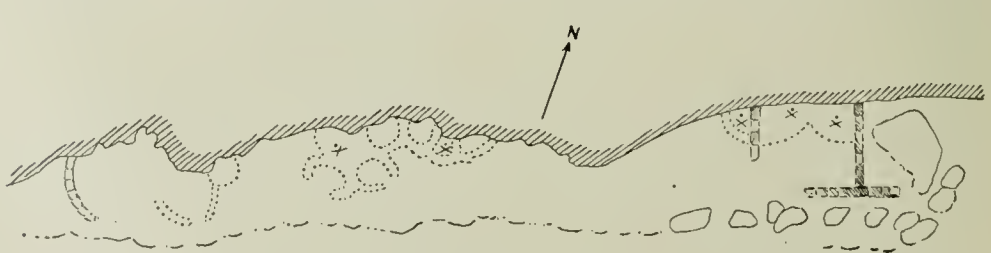
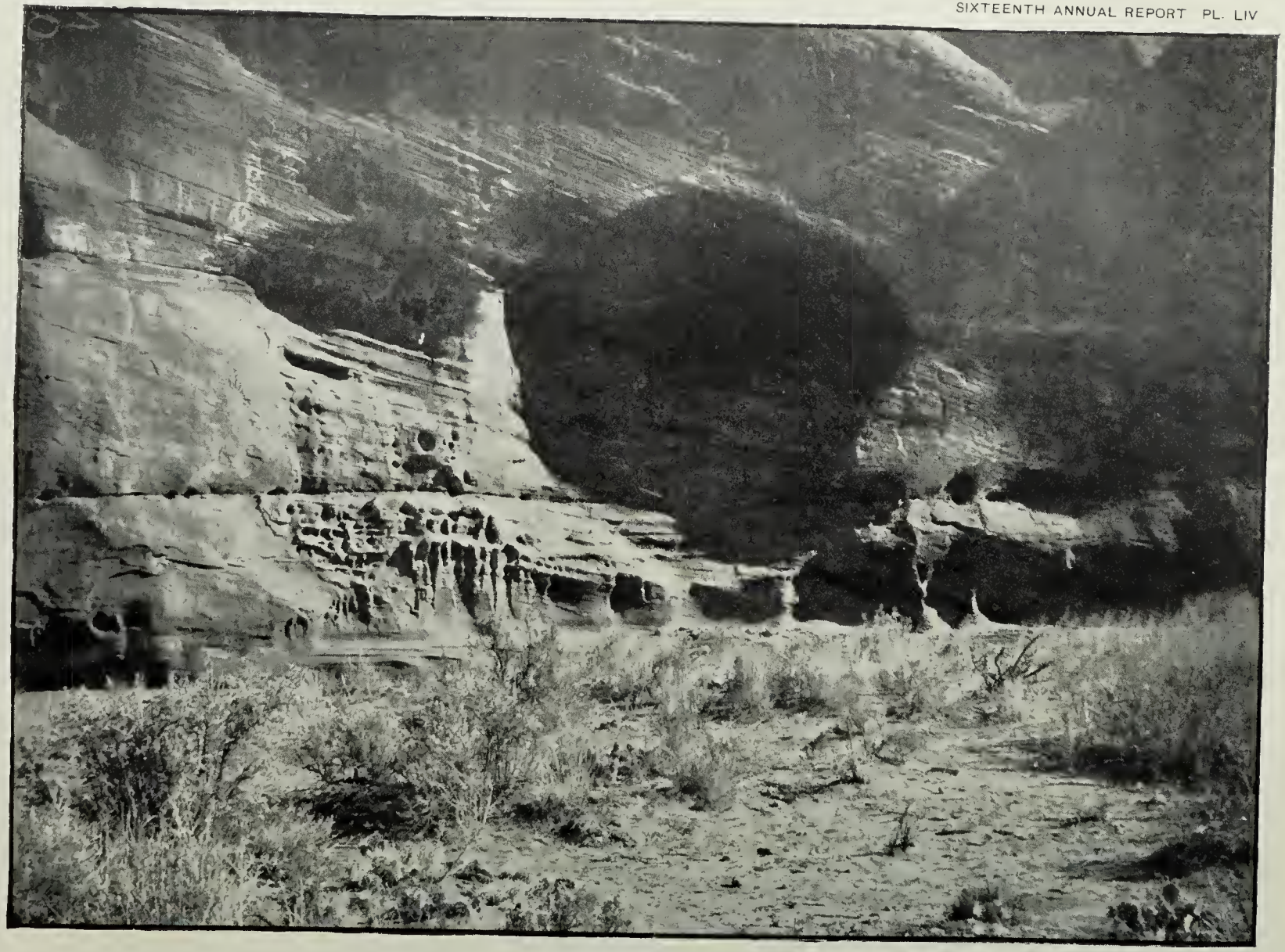


FIG. 62—Plan of outlook and burial cists, No. 64.

the canyon. It occurs at the point marked 45 on the map, and occupies a small flat area almost on top of the talus 300 feet or more



CLIFF RUIN No. 14

above the stream bed. It is just below the ruin described and illustrated on page 144 (figure 48), and hardly 20 feet distant from it, and yet it does not appear to have been connected with it. It consists of a single large room, 20 feet long by 11½ feet wide outside, and the site commands an extensive prospect over bottom lands on both sides of the canyon, and above, but the only opening in the wall on that side is a little peephole 6 inches square and 2 feet from the ground. This is sufficient, however, to command nearly the whole outlook. There is a doorway on the eastern side, one side of which, fairly well finished, remains. There was apparently no other opening, unless one existed on the western side, where, in the center, the wall is broken down to within 2 feet of the ground. Along the western side of the room, at the present ground surface, there are remains of a bench about a foot wide; the eastern side is covered above this level.

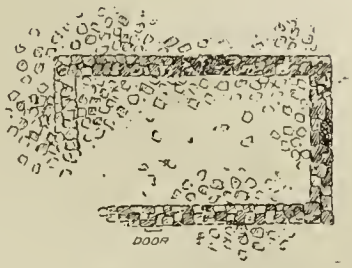


FIG. 63—Plan of rectangular room No. 45.

The masonry is very rough and chinked only with large stones. The interior is roughly plastered in places, and small pieces of stone are stuck on flat. The corners are rounded. Externally the masonry has

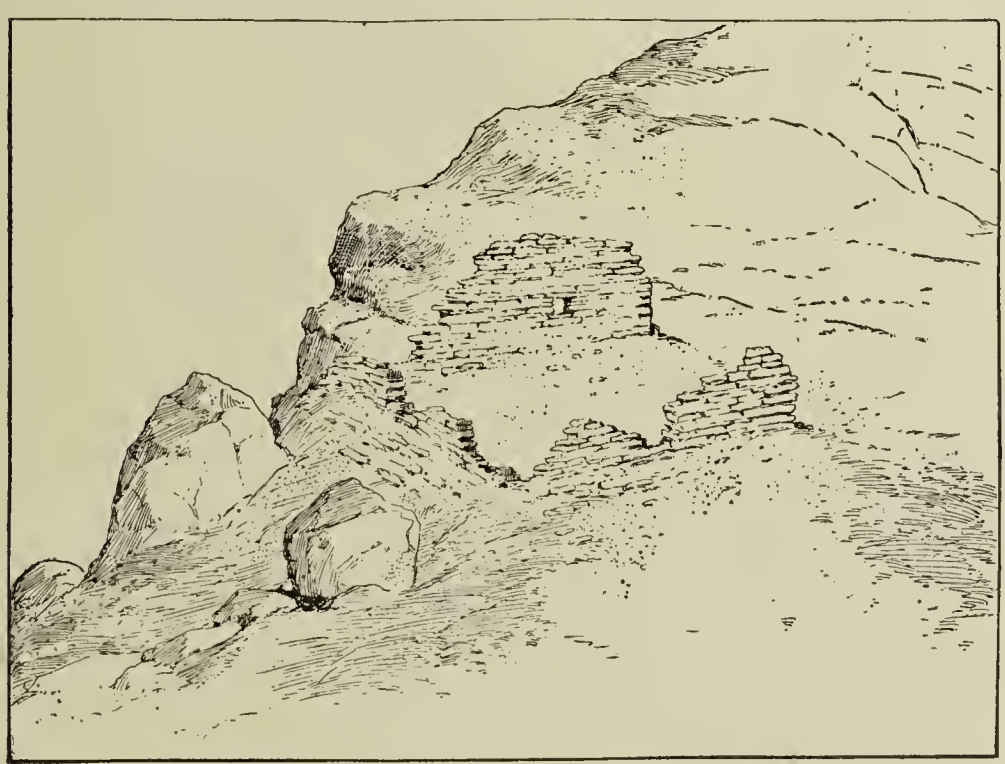


FIG. 64—Rectangular single room.

the appearance of stones laid without mortar, like a Navaho stone corral, and were it not for the occurrence of other similar remains, it might be regarded as of Navaho or white man's construction, as the size,

site, plan, and masonry are all anomalous. Figure 64 shows an example, however, closely resembling the one described in these features, and figure 65 shows another. Altogether there are four or five examples, distributed over a considerable area.

Somewhat similar wall remains are seen in places on the canyon bottom, where they are always of modern Navaho origin, and it is quite possible that the ruins above mentioned should be placed in the same category. It will be noticed that in the plan the doorway or entrance opening is on the eastern side—an invariable requirement of Navaho house constructions; but it is only within recent times that the Navaho have constructed permanent, rectangular abodes, and even now such houses are rarely built. It is difficult to understand, moreover, why recourse should be had to such inconvenient sites, if the structures are of Navaho origin, as these Indians always locate their hogans on the bottom lands, or on some slight rise overlooking them.

Distributed throughout the canyons, wherever a favorable situation could be found, there are a great number of sites resembling those of

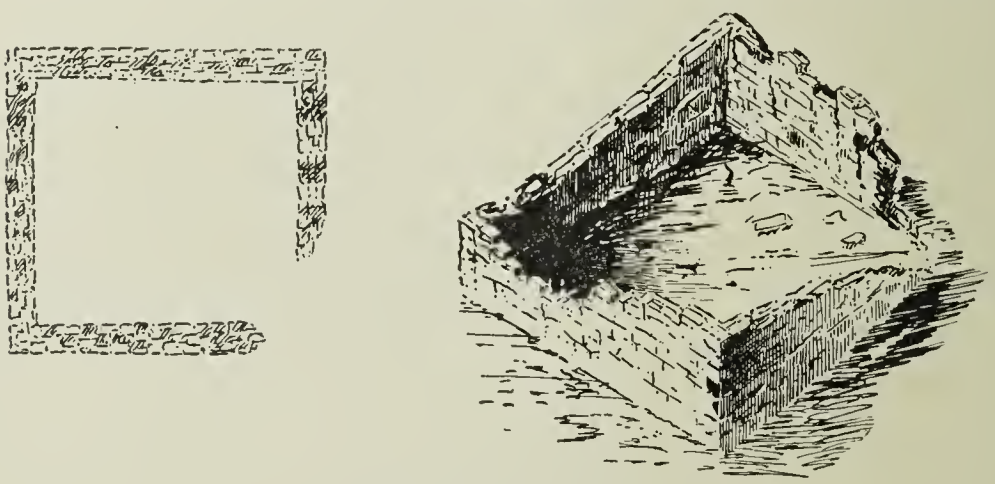
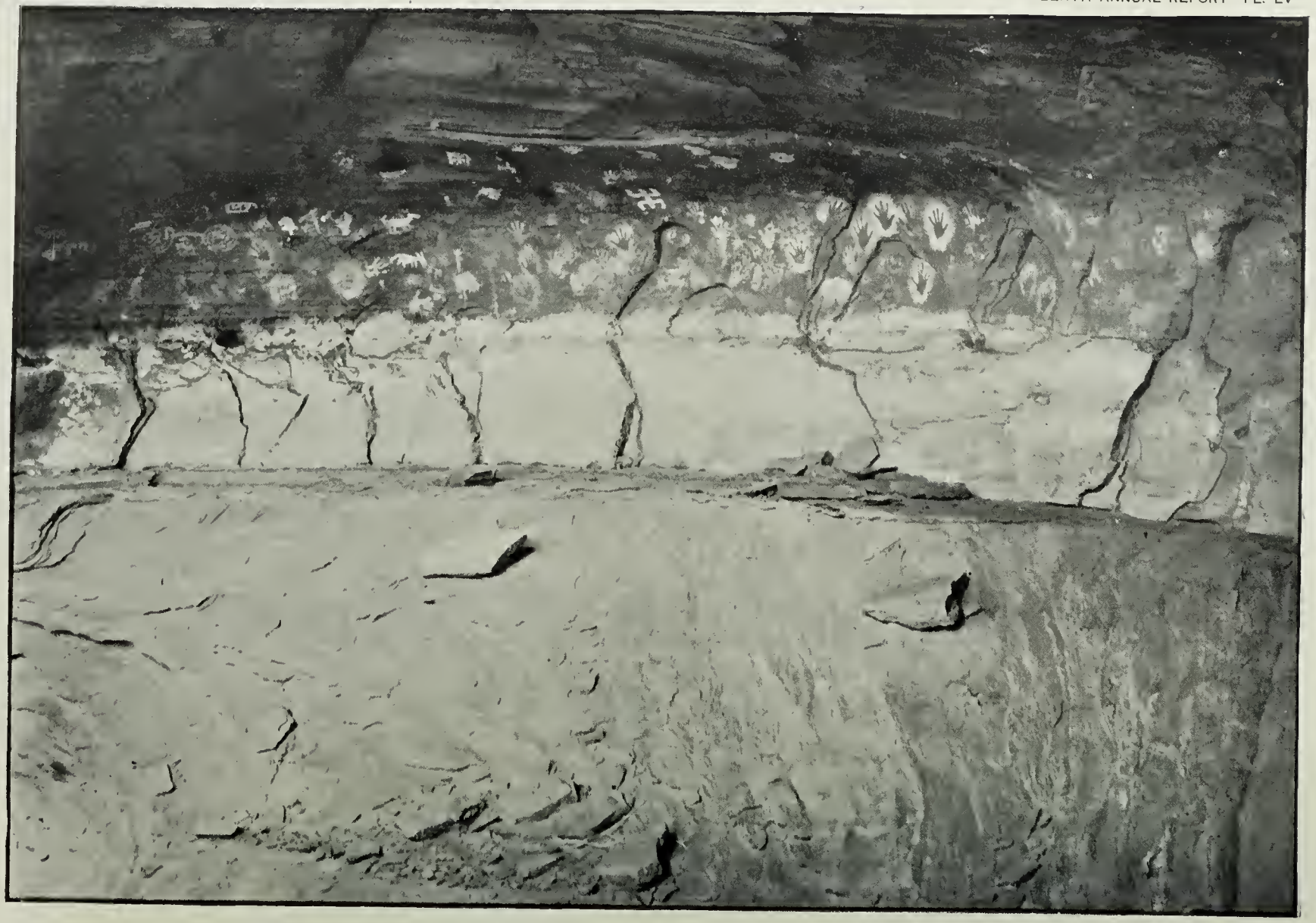


FIG. 65—Single-room remains.

the cliff outlooks, but showing now no standing wall. There is always some evidence of human occupancy, often many pictographs on the back wall, as in an example in the lower part of the canyon shown in plate LV. This occurs at point 2 on the map, in a cove perhaps 100 feet across, with caves on the northern and southern sides.

In the southern cave there are no traces of masonry, but the back of the cave is covered with hand prints and pictographs of deer, as shown in the plate. In the northern cave there are traces of walls. Many of the sites do not show the faintest trace of house structures; some of them have remains of storage cists, and many have remains of Navaho burial cists, associated with pictographs not of Navaho origin. Some idea of the number and distribution of these sites may be obtained from the following list, wherein the numbers represent the location shown on the detailed map: 2, 8, 9, 11, 18, 19, 21, 22, 23, 25, 26, 30, 38, 39, 40, 42, 43, 53, 54, 57, and 66—in all 21 sites which occur between the mouth



SITE MARKED BY PICTOGRAPHS

of De Chelly and the junction of Monument canyon, 13 miles above. Beyond this point they are rare, as the areas of cultivable land become scarce. A similar distribution prevails in Del Muerto.

DETAILS

SITES

The character of the site occupied by a ruin is a very important feature where the response to the physical environment is as ready and complete as it is in the ancient pueblo region. This feature has not received the attention it deserves, for it is more than probable that in the ultimate classification of ruins that will some day be formulated the site occupied will be one of the principal elements considered, if not the most important. The site is not so important per se, but must be considered with reference to the specific character of the ruin upon it, its ground plan, the character of other ruins in the vicinity which may have been connected with it, and its topographic environment. The character and ground plan of a cliff ruin would be so much out of place on an open valley site that it would immediately attract attention. The reverse is equally remarkable.

Considering all that has been written about the cliff ruins as defensive structures, it is strange how little direct evidence there is to support the hypothesis; how few examples can be cited which show anything that can be construed as the result of the defensive motive except the general impression produced on the observer. Nor, on the other hand, do these ruins as a whole give any support to the theory that they represent an intermediate stage in the development of the pueblo people. Some few may, perhaps those examined by Mr F. H. Cushing south and east of Zuñi do; but more than 99 per cent of them give more support to a theory that they are the ultimate development of pueblo architecture than to the other hypothesis, for they contain in themselves evidence of a knowledge of construction equal and even superior to that shown in many of the modern pueblo villages. The only thing anomalous or distinctive about the cliff ruins, considered as an element of pueblo architecture, is the character of site occupied. If this were dictated by the defensive motive, it would seem reasonable to suppose that the same motive would have some direct influence on the structures, yet examples where it has affected the arrangement of rooms or ground plan or the character of the masonry are exceedingly rare and generally doubtful.

It is well to specify that in the preceding remarks the term cliff ruin has been applied to small settlements, comprising generally less than four rooms, sometimes only one or two, and usually located on high and almost inaccessible sites. These are comprised in class IV of the classification here followed. Regular villages located in the cliffs or on top of the talus (class III) are a different matter. These have nothing in common with the small ruins, except that sometimes there is a similarity

of site. Doubtless in some of these ruins the defensive motive operated to a certain extent. In classes I and II, however, the influence of the defensive motive, in so far as it affected the character of site chosen, is conspicuous by its absence. As there is no evidence that the cliff ruins of class IV were separate and distinct from the other ruins, but the contrary, the defensive motive may be assigned a very subordinate place among the causes which produced that phase of pueblo architecture found in Canyon de Chelly.

An hypothesis as to the order in which sites of the various classes were occupied can not be based on the present condition of the ruins. It is more than likely that the older ruins served as quarries of building material for succeeding structures erected near them, and probably some of the cliff ruins themselves served in this way for the erection of others, for there are many sites from which the building stone has been almost entirely removed; yet there is no doubt that these sites were formerly occupied. The Navaho also have contributed to the destruction. Notwithstanding their horror of contact with the remains of the dead, quite a number of buildings have been erected by these Indians with material derived from adjacent ruins. It is evident that the gathering of this material would be a much lighter task than to quarry and prepare it, no matter how roughly the latter might be done.

In a study of some ruins in the valley of the Rio Verde, made a few years ago, a suggestion was made of the order in which ruins of various kinds succeeded one another—a sort of chronologic sequence, of which the beginning in time could not be determined. Studies of the ruins and inhabited villages of the old province of Tusayan (Moki) and Cibola (Zuñi), and a cursory examination of ruins on Gila river, show that they all fall easily into the same general order, which is somewhat as follows:

1. The earliest form of pueblo house is doubtful. As a rule, in most localities the earliest forms are already well advanced. As it is now known that the ancient pueblo region was not inhabited by a vast number of people, but by a comparatively small number of little bands, each in constant though slow movement, this condition is what we would expect to find. It is probable that the earliest settlements consisted of single houses or small clusters located in valleys convenient to areas of cultivable land and on streams or near water.

2. The next step gives us villages, generally of small size, located on the foothills of mesas and overlooking large areas of good land which were doubtless under cultivation. This class comprises more examples perhaps than any other, and many of them come well within the historic period, such as six of the seven villages of Tusayan at the time of the Spanish conquest in 1540, all of the Cibolan villages of the same date, and some of the Rio Grande pueblos of that time.

3. In some localities, though not in all, the small villages were at a later period moved to higher and more inaccessible sites. This change has taken place in Tusayan within the historic period, and in fact was

not wholly completed even fifty years ago. The pueblo of Acoma was in this stage at the time of the conquest, and has remained so to the present day. As a rule each of the small villages preserved its independence, but in some cases they combined together to occupy together a high defensive site. Such combination is, however, unusual.

4. The final stage in the development of pueblo architecture is the large, many-storied, or beehive village, located generally in the midst of broad valleys, depending on its size and population for defense, and usually adjacent to some stream. In this class of structure the defensive motive, in so far as it affected the choosing of the site, entirely disappears. The largest existing pueblo, Zuñi, made this step early in the eighteenth century; the next largest, Taos, was probably in this stage in 1540, and has remained so since. In some cases ruins on foothill sites (2) have merged directly into many-storied pueblos on open sites (4), without passing through an intermediate stage.

There is another step in the process of development which is now being taken by many pueblos, which, although an advance from the industrial point of view, is to the student of architecture degeneration. This consists of a return to single houses located in the valleys and on the bottom lands wherever convenience to the fields under cultivation required. This movement is hardly twenty years old, but is proceeding at a steadily accelerating pace, and its ultimate result is the complete destruction of pueblo architecture. Whatever we wish to know of this phase of Indian culture must be learned now, for two generations hence probably nothing will remain of it.

This hasty sketch will illustrate some of the difficulties that lie in the way of a complete classification of the ruins of the pueblo country. It is impossible to arrange them in chronologic sequence, because they are the product of different tribes who at different times came under the influence of analogous causes, and results were produced which are similar in themselves but different in time. It is believed, however, that the classification suggested exhibits a cultural sequence and probably within each tribe a chronologic order.

In this classification no mention has been made of the cliff and cave ruins. These structures belong partly to class III, villages on defensive sites, and partly to a subclass which pertained to a certain extent to all the others. In the early stages of pueblo architecture the people lived directly on the land they tilled. Later the villages were located on low foothills overlooking the land, but in this stage some of the villages had already attained considerable size and the lands overlooked by them were not sufficient for their needs. As a consequence some of the inhabitants had to work fields at a distance from the home village, and as a matter of convenience small temporary shelters were erected near by. In a still later stage, when the villages were removed to higher and more easily defended sites, the number of farming shelters must have largely increased, as suitable sites which also commanded large areas of good land could not often be found. At a still later

stage, when the inhabitants of a number of small villages combined to form one large one, this difficulty was increased still more, and it is probable that in this stage the construction of outlying farming settlements attained its maximum development. Often whole villages of considerable size, sometimes many miles from the home pueblo, were nothing more than farming shelters. These villages, like the single-room shelters, were occupied only during the farming season; in the winter the inhabitants abandoned them completely and retired to the home village.

Some farming villages, such as those described above, are still in use among the pueblos. The little village of Moen-Kapi, attached to Oraibi, but 75 miles distant from it, is an example. There are also no fewer than three villages in the Zuñi country of the same class. Nutria, Pescado, and Ojo Caliente are summer villages of the Zuñi, although distant from that pueblo from 15 to 25 miles. It is significant that none of these subordinate villages possess a kiva. It is believed that the cliff ruins and cavate lodges, which are merely variants of each other due to geological conditions, were simply farming shelters of another type, produced by a certain topographic environment.

The importance which it is believed should attach to the site on which a ruin is found will be apparent from the above. It was certainly a prominent element in the De Chelly group. A study of the detailed map here published will illustrate how completely the necessity for proximity to an area of cultivable land has dominated the location of the settlements, large and small; and a visit to the place itself would show how little influence the defensive motive has exercised. Near the mouth of the canyon, where cultivable areas of land are not many, there are few ruins, but those which do occur overlook such lands. In the middle portion, where good lands are most abundant, ruins also are most abundant; while above this, as the rocky talus develops more and more, the ruins become fewer and fewer; and in the upper parts of the canyon, beyond the area shown on the map, they are located at wide distances apart, corresponding to little areas of good land so located. Not all of the available land was utilized, and only a small percentage of the available sites were built upon. Between the mouth of De Chelly and the junction of Monument canyon, 13 miles above, there are seventy-one ruins. A fair idea of their distribution may be obtained from a study of the detailed map (plate XLIII), in conjunction with the following figures:

I. Old villages on open sites occur at the points marked 12, 41, 52, 17*a*, 55, 60, 61, and 67; in all, nine sites; principally in the upper part of the canyon.

II. Home villages on bottom lands, located without reference to defense, occupy sites 3, 4, 17, 20, 28, 48, and 51; in all, seven sites. Probably there are many more ruins of this class and the preceding, now so far obliterated as to be overlooked or indistinguishable.

III. Home villages on defensive sites occur at the points marked 5, 10, 13, 15, 16, 27, 31, 32, 34, 36, 37, 40, 44, 47, 59, 62, and 66; in all, seventeen. This includes many sites where the settlements were very small, often only a few rooms, but there is always at least one kiva.

IV. Cliff outlooks and farming shelters occupy sites 2, 6, 7, 8, 9, 11, 14, 18, 19, 21, 22, 23, 24, 25, 26, 29, 30, 33, 35, 38, 39, 42, 43, 45, 46, 49, 50, 53, 54, 56, 57, 64, 63, 65, 68, 69, and 70; in all, thirty-seven, or more than half. Some of these sites are now marked only by Navaho remains, and possibly a small percentage of them are of Navaho making, but the sites which are clearly and unmistakably Navaho are not mentioned here. Of all the sites only one (No. 7) is actually inaccessible without artificial aid.

The absence of any attempt to improve the natural advantages of the sites is remarkable. No expedients were employed to make access either easier or more difficult, except that here and there series of hand and foot holes have been pecked in the rock. Steps, either constructed of masonry or cut in the rock, such as those found in the Mancos canyon and the Mesa Verde region, are never seen here. The cavities in which the ruins occur are always natural; they are never enlarged or curtailed or altered in the slightest degree, and very rarely is the cavity itself treated as a room, although there are some excellent sites for such treatment. The back wall of a cove is often the back wall of a village, but aside from this the natural advantages of the sites were seldom realized.

The settlements were always located with reference to the canyon bottom, and access was never had from above, notwithstanding that in some cases access from above was easier than from below. Yet the inhabitants must necessarily have obtained their supply of firewood from above, as the quantity in the canyons, especially in that part where most of the ruins occur, is very limited. The Navaho throw the wood over the cliffs, afterward gathering up the fragments below and carrying them on their backs to their hogans at various points on the canyon bottom. The crash of falling logs, dropped or pushed over the edge of a cliff, sometimes 400 or 500 feet high, is not an infrequent sound in the canyon, and is at first very puzzling to the visitor.

The canyon walls are so nearly vertical, or rather so large a proportion is vertical, that egress or ingress, except at the mouth of the canyon, is a matter of great difficulty. Near the junction of Monument canyon, 13 miles above the mouth of De Chelly, there is a practicable horse trail ascending a narrow gorge to the southeast. The Navaho call it the Bat trail, on account of its difficulties. Another horse trail crosses Del Muerto some 8 or 10 miles above its mouth. With these exceptions there is no point where a horse can get into the canyons or out of them, but there are dozens of places where an active man, accustomed to it, can scale the walls by the aid of foot-holes which have been pecked in the rock at the most difficult places. These foot trails are in constant use by the Navaho, who ascend and descend by them with apparent ease, but it is doubtful whether a white man could be induced to climb them, except perhaps under the stress of necessity. There are even some trails over which sheep and goats are driven in and out of the canyon, but anyone who had not seen the flocks actually passing over the rocks would declare such a feat impossible. Some of these trails at least are of Navaho origin. Whether any of them were

used by the former dwellers in the canyon can not now be determined; it seems probable that some of them were.

Plate LVI shows a characteristic site in the lower part of the canyon. It occurs at the point marked 8 on the map, and is now quite

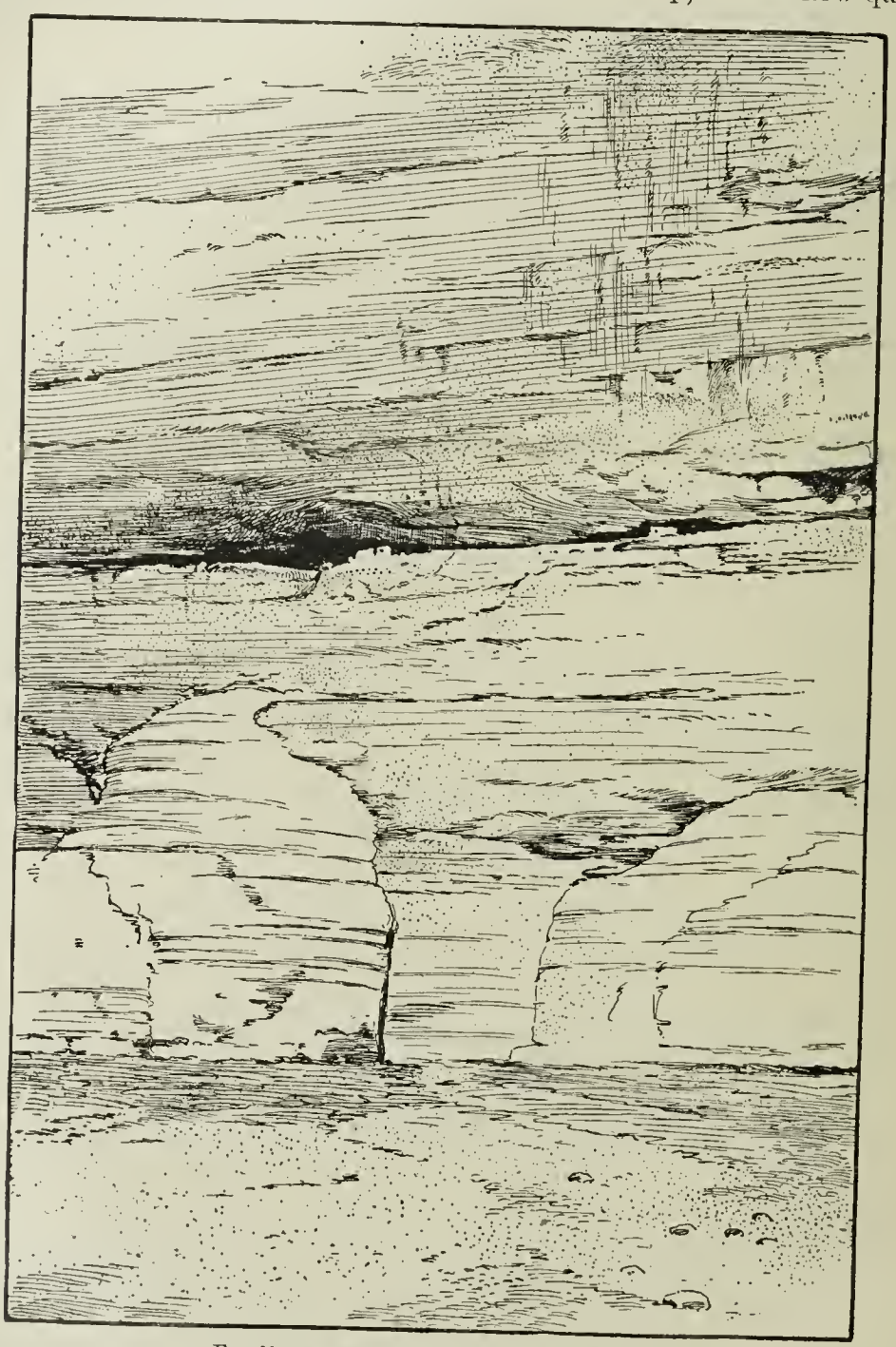


FIG. 66—Site apparently very difficult of access.

difficult of approach, owing to the wearing away or weathering of a long line of foot-holes in the sloping rock, but formerly access was easy enough. It is now marked by a cluster of Navaho burial cists. Figure 66 shows an example that occurs in De Chelly, about 8 miles

SITE DIFFICULT OF APPROACH

above the junction of Monument canyon. At first glance, and at a distance, this site appears to be really inaccessible, but a close inspection of the figure will show that it could be reached with comparative little difficulty over the rounded mass of rock shown to the left. By cutting off that side of the figure it could be made to serve as an illustration of a wholly inaccessible ruin.

MASONRY

The ancient pueblo builder, like his modern successor, was so closely in touch with nature, so dependent on his immediate physical surroundings, that variations in some at least of his arts are more natural and to be expected than uniformity. Especially is this true of the art of construction, and variations in masonry are more often than not the result of variations in the material employed, which is nearly always that most convenient to hand. Yet there were other conditions that necessarily influenced it, such, for example, as the character of the structure to be erected, whether permanent or temporary. The summer village of Ojo Caliente presents a type of masonry much ruder than any found in the home village of Zuñi, although both were built and occupied by the same people at the same time.

Within the limits of Canyon de Chelly, where the physical conditions and the character of material are essentially uniform, a considerable variation in the masonry is found, implying that some conditions other than the usual ones have influenced it. Were the masonry of one class of ruins inferior or superior throughout to that of another it might be easily explained, but variations within each class are greater than those between classes. Conditions analogous to those which prevailed in the case of Ojo Caliente and Zuñi may have governed here, or there may have been other conditions of which we now know nothing. It may be that sites originally occupied as farming shelters subsequently became regular villages, as has happened in other regions. The position of the kivas in many of the ruins suggests this. As a whole the masonry is inferior to that found in the Mancos canyon and the Chaco, and superior to that of Tusayan, but, as in Tusayan, where the masonry is sometimes very roughly constructed, the builders were well acquainted with the methods which produced the finer and better work.

The highest type of masonry in the pueblo system of architecture consists of small blocks of stone of nearly uniform size, dressed, and laid in courses, and rubbed down in situ. No attempt was made to break joints. This system requires the careful preparation of the material beforehand, and examples of it are not very common in Canyon de Chelly. As a variant we have walls composed of stones of fairly uniform size, laid with the best face out and with the interstices chinked with small spalls. The chinking is carried to such an extent in some places, as in the Chaco ruins, that the walls present the effect of a mosaic composed of small spalls. Chinking is almost a universal practice, and in some localities had passed, or was passing, from a mere

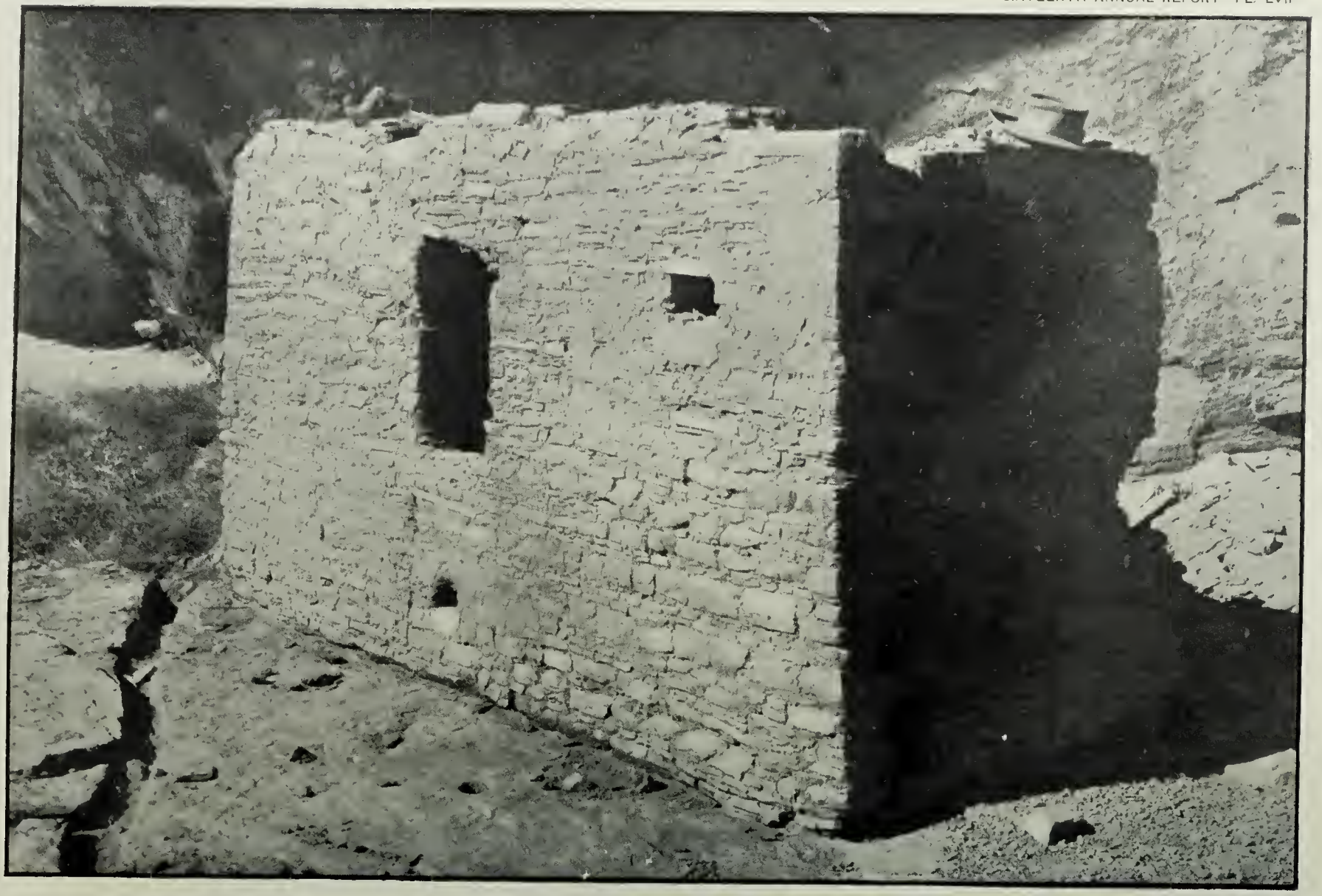
constructive to a real decorative feature. Here we have the beginning of that architecture which has been defined by Ferguson as "ornamental and ornamented construction"—in other words, of architecture as an art rather than as a craft.

The use of an exterior finish of plaster was conducive to poor masonry. Such plastering is found throughout the region, but it is much more abundant in the modern than in the ancient work. Perhaps we may find in this a suggestion of relative age; not in the use of plastering, but in its prevalence.

Pueblo masonry is composed of very small units, and the results obtained testify to the patience and industry of the builders rather than to their knowledge and skill. In fact, their knowledge of construction was far more limited than would at first sight be supposed. The marked tabular character of the stone used rendered but a small amount of preparation necessary for even the best masonry. For over 90 per cent of it there was no preparation other than the selection of material. The walls and buildings were always modified to suit the ground, never the reverse, and instances in which the site was prepared are very rare, if not indeed unknown. There are no such instances in De Chelly, where sites were often irregular, and a small amount of work would have rendered them much more desirable.

Plate LVII shows a type of masonry which is quite common in De Chelly. It is the west room of ruin 16, near the mouth of Del Muerto An attempt at regularity, and possibly at decorative effect, is apparent in the use of courses of fairly uniform thickness, alternating with other courses or belts composed of small thin fragments. Beautiful examples of masonry constructed on this method occur in the Chaco ruins, but here, while the method was known, the execution was careless or faulty. Chinking with small spalls has been extensively practiced and gives the wall an appearance of smoothness and finish. A similar wall, rather better constructed, occurs at the point marked 3 on the map, and in this case the stones composing the wall were rubbed down in situ. Another wall, which occurs in the same ruin, is shown in plate LVIII. In places very large stones have been used, larger than one man could handle conveniently, but the general effect of the wall face is very good. This effect was obtained by placing the best face of the stone outward and by careful chinking.

Chinking was sometimes done, not with slips of stone driven in with a hammer, after the usual style, but with bits of mud pressed in with the fingers. The mud was used when about the consistency of modeling clay, and bears the imprints of the fingers that applied it; even the skin markings show clearly and distinctly. From this use of mud to its use as an exterior plaster there is but a short step; in fact, examples which are intermediate can be seen throughout the canyon. In places mud has been applied to small cracks and cavities in larger quantities than was necessary, and the excess has been smoothed over the



MASONRY IN CANYON DE CHELLY

adjacent stones forming a wall partly plastered, or plastered in patches. Plate LIX, which shows the interior of a room in ruin 10, will illustrate this. Here the process has been carried so far that the wall is almost plastered, but not quite. In plastered walls the process was carried a step farther, and the surface was finished by the application of a final coat of mud made quite liquid. The interior plastering of kivas was always much more carefully done than that of any other walls. Owing to blackening by smoke and recoating, the thickness of the plastering in kivas can be easily made out. Often it is as thin as ordinary paper.

Plate LX shows walls in which an abundance of mud mortar was used, and the effect is that of a plastered wall. The difference between these walls and those shown in plate LVII is only one of degree, the wall shown in plate LIX being of an intermediate type. No instance occurs in the canyon where a coating of mud was evenly applied to the whole surface of a wall, in the way, for example, that stucco is used by us. It seems probable, therefore, that the application of plaster as a finish grew out of the use of stone spalls for chinking, and its prevalence in modern as compared with old structures is suggestive. It is not claimed, however, that because we have examples of the intermediate stages in De Chelly that the process was developed there. The step is such a slight one that it might have been made in a hundred different localities at a hundred different times or at one time; but it is well to note that in any given group of ruins or locality it is likely to be later than masonry chinked with stones. Surface finishing in mud plaster is the prevailing method at the present day, and well-executed masonry of stone carefully chinked is almost invariably ancient. The use of surface plaster is largely responsible for the deterioration of stonework that has taken place since the beginning of the historic period. The modern village of Zuñi, which dates from the beginning of the eighteenth century, although built on the site of an older village, is essentially a stone-built village, though that fact would never appear from a cursory examination, so completely is the stonework covered by surface plaster.

In Tusayan (Moki) walls have been observed in progress of erection. The stones were laid up dry, and some time after, when the rains came and pools of water stood here and there in pockets on the mesa top, mud mortar was mixed and the interstices were filled. This method saved the transportation of water from the wells below up to the top of the mesa, a task entailing much labor. Doubtless a similar method was followed in De Chelly, where the stream bed carries water only during a part of the year. But stone was also actually laid in mud mortar, as shown in plate LII, which illustrates a rough type of masonry.

It is probable that the practice of chinking grew up out of the scarcity of water, when walls were erected during the dry season and finished when the rains made the manufacture of mud mortar less of a task. The rough wall shown in the illustration is the outside of an interior wall of a kiva, and it was probably covered by the rectangular

inclosing wall that came outside of it. It will be noticed that chinking, both with mud and with spalls, was extensively practiced and seems here to have been an essential part of the construction. In this example it could have no relation to the finish of the wall, for the wall was not finished.

Much of the masonry in the canyon is of the type described, but examples differ widely in degree of finish and in material selected. Some of the walls appear very rough and even crude, so much so that they almost appear to be the first efforts of a people at an unknown art, but a closer inspection shows that even the rudest walls were erected with a knowledge of the principles which were followed in the best ones, and that the difference resulted only from the care or lack of care employed. The rudest walls are much superior to the masonry of the Navaho cists which are found in conjunction with them and which are constructed on a different method.

Although walls were often built on sloping rock, and the builders had experience and at times disastrous experience to guide them, the necessity for a flat and solid foundation was never appreciated. Walls were sometimes built on loose débris; even refuse which had been covered and formed an artificial soil was considered sufficient. There are many instances in the canyon where lack of foresight or lack of knowledge in this respect has brought about the destruction of walls. Walls resting on foreign material occur throughout the region; they are not confined to any one class of ruins or to any part of the canyon, but are found as much or more in the most recent as in the most ancient examples. Mummy Cave ruin and Casa Blanca are good examples. In the latter the small room on the left of the upper group (plate XLVII) is especially interesting. The side walls appear to rest on a deposit of refuse nearly 2 feet thick, which in turn rests on the sloping rock. The front wall is supported by a buttress as shown; without this support it would certainly have been pushed out. The buttress appears to have been built at the same time as the front wall, although its use in this way is not aboriginal. The whole arrangement is such as would result if this room, originally represented by a low front wall perhaps, were constructed when the site became inadequate and consequently at a late period in its occupancy.

The character of the refuse and débris upon which some of the walls rest is worth notice. It is well known that sheep were introduced into this country by the Spaniards, and the presence in the ruins of sheep dung, or of a material which closely resembles it, is important. Much of this is due to subsequent Navaho occupancy, and many ruins are used today by these Indians as sheepfolds. It is said, moreover, that at the time of the Navaho war, when the soldiers bayoneted all the sheep they could find, large flocks were driven up into some cliff ruins that are almost inaccessible, and kept there for a time in security. But many instances are found where the walls rest directly upon layers

CHINKED WALLS IN CANYON DE CHELLY

of compacted dung. An example is shown in plate LII, and others are mentioned in the text under the descriptions of various ruins.

It has been suggested that the compacted dung found in the ruins was the product not of sheep, but of some other domesticated animal which existed in this country at the time of the first Spanish invasion, but the evidence to support this hypothesis is so very slight that so far the suggestion is only a suggestion. Not the slightest trace of this animal has been found, although it is alleged that it was domesticated among the pueblos three hundred and fifty years ago.

Although the idea of a strengthening or supporting buttress is thought to be a foreign introduction, a hypothesis that is strengthened by the occurrence of other features, the masonry itself is aboriginal in its principles and probably also in execution. The conservatism of the Indian mind in such matters is well known. The Zuñi today use stone more than adobe, although for a hundred years or more there has been an adobe church in the midst of the village.

Adobe construction in this region is only partially successful. North of the Gila river, in the plateau country, the climate is not suited to it; the rains are too heavy and the frosts are destructive. Constant vigilance and prompt repairs are necessary, and even then the adobe work is not satisfactory. Certainly in the northern part of the country the aborigines would not have developed this method of construction in the face of the difficulties with which it is surrounded; yet there are examples of adobe work in some of the most important ruins in De Chelly, as has already been stated. The fact that the only previously known examples of adobe work occur in ruins which are known to have been inhabited subsequent to the Spanish conquest, such as the ruin of Awatobi, in Tusayan, is suggestive. Moreover, adobe construction in this region belongs to a late period; for the walls are almost always very thin, usually 6 or 7 inches. The old type of massive walls, 2 or even 3 feet thick, are seldom or never found constructed of adobe, although such thickness is more necessary in this material than in stone.

There is another method of construction which, although not masonry, should be noticed here. This is the equivalent of the Mexican "jacal" construction, and consists of series of poles or logs planted vertically in the ground close to each other and plastered with mud either outside or on both sides. The only example of this found in the canyon occurs in the western part of the lower Casa Blanca ruin, and has already been mentioned. Did it not occur elsewhere it could be dismissed here as simply another item of evidence of the modern occupancy of the ruin, but Dr W. R. Birdsall mentions walls in the Mesa Verde ruins which are "continued upward upon a few tiers of stone by wickerwork heavily plastered inside and outside"[1] and Nordenskiöld mentions a similar construction in the interior of a kiva. Whether a similar foundation or lower part of stone existed in the Casa Blanca ruin could not be determined without excavation.

[1] Bull. Am. Geog. Soc., vol. XXIII, p. 598.

OPENINGS

The ruins in De Chelly are so much broken down that few examples of openings now remain; still fewer are yet intact; but there is no doubt that they are of the regular pueblo types. Most of the openings in the De Chelly ruins are rectangular, of medium size, neither very large nor very small, with unfinished jambs and sills, and with a lintel such as that shown in plate LVIII, composed of one or two series of light sticks, sometimes surmounted by a flat stone slab. This example occurs at the point marked 3 on the map, in what was formerly an extensive village. The wall on the left, now covered by loosely piled rocks, was pierced by a narrow notched doorway. The opening shown in the illustration, which is in the northern wall, is 2 feet high and 14 inches wide; its sill is about 18 inches from the ground. The lintel is composed of six small sticks, about an inch in diameter, surmounted by a flat slab of stone, very roughly shaped, and separated from the sticks by 2 inches of mud mortar.

Plate LVII shows an opening which occurs in ruin No. 16. The building consisted of two rooms, between which there was no communication. The eastern room was entered by the doorway shown in the illustration, which is 2 feet above the ground and 2 feet high. To facilitate ingress a notch was dug in the wall about 8 inches from the ground. The western room was entered through a large doorway, shown in plate LI. The sill is about 8 inches above the ground; the opening is 3 feet high and 14 inches wide. The lintel is composed of small sticks, with a slab of stone above them, and the top of the opening and perhaps the sides were plastered.

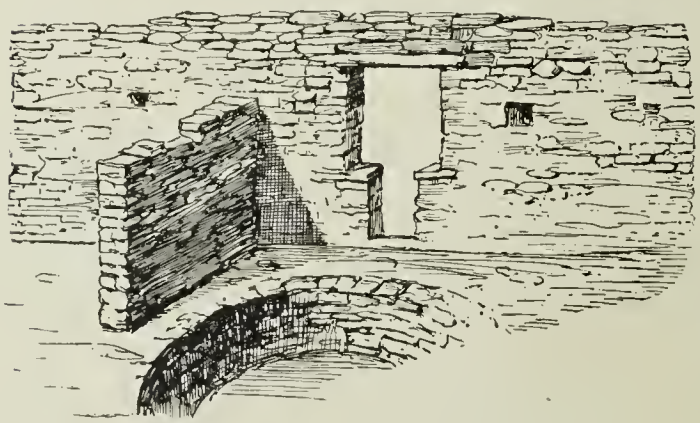


FIG. 67—Notched doorway in Canyon de Chelly.

The notched or T-shape doorway, which is quite common in the Mesa Verde ruins and in Tusayan, is not abundant in De Chelly, but some examples can be seen there. One is shown in figure 67, which illustrates the type. There is no doubt that doorways of this kind developed at a time when no means existed for closing the opening, except blankets or skins, and when loads were carried on the backs of men. It often happened that doorways originally constructed of this style were afterward changed by partial filling to square or rectangular openings. The principal doorway in the front wall of the White House proper was originally of T-shape; at some later period, but before

A PARTLY PLASTERED WALL

the white coating was applied, the left-hand wing and the standard below it were filled in, leaving an almost square opening. This later filling is not uncommon in De Chelly, and is often found in Tusayan, where openings are sometimes reduced for the winter season and enlarged again in the summer. Many openings are completely closed, either by filling in with masonry or by a stone slab, and examples of both of these methods are found in De Chelly. In the third wall from the east, in the upper part of Casa Blanca ruin, there is a well-finished doorway sealed by a thin slab of stone set in mud. On the right side of the opening, about the middle, a loop or staple of wood has been built into the wall, and in the corresponding place on the left side a stick about half an inch in diameter projects. An opening into the small room west of the White House proper has a similar contrivance, and another example occurs in the front wall of the small single room in the eastern end of the ruin. Oddly enough the three examples that occur in this ruin are all found in adobe walls.

This feature appears to have been a contrivance for temporarily closing openings which were provided with stone slabs, and the latter were sealed in place with mud mortar when it was desired to close the room permanently. Examples, identical even in details, have been found in the Mancos canyon, and one is described and illustrated by Chapin,[1] who states that the slab was 14½ inches wide at one end, 15½ at the other, and 25 inches high, with an average thickness of an inch. He mentions staples on both sides. Nordenskiöld[2] illustrates another or possibly the same example. He notes, however, an inner frame composed of small sticks and mud against which the slab rested. He thinks the notched doorways belonged to rooms most frequented in daily life, while the others belonged in general to storerooms or other chambers requiring a door to close them.

Taken as a whole, the settlements in De Chelly appear to have been well provided with doorways and other openings, and there is no perceptible difference in this respect between the various classes of ruins. Openings were freely left in the walls, wherever convenience dictated, and without regard to the defensive motive, which, in the large valley pueblos, brought about the requirement that all the first-story rooms should be entered from the roof, a requirement which has only recently given way to the greater convenience of an entrance on the ground level.

ROOFS, FLOORS, AND TIMBER WORK

In the pueblo system of construction roofs and floors are the same; in other words, the roof of one room is the floor of the room above, and where a room or house is but one story high no change in the method of construction is made. The erection of walls was only a question of time, as the unit of the masonry is small; but the construction of a roof was a much harder task, as the beams were necessarily

[1] Land of the Cliff Dwellers, pp. 149–150, pl. opp. p. 155.
[2] Cliff Dwellers of the Mesa Verde, pp. 52–53, fig. 28.

brought from a distance, sometimes a very long distance. The Tusayan claim that some of the timbers used in the construction of the mission buildings, which were established prior to the insurrection of 1680, were brought on the backs of men from San Francisco mountains, a distance of over 100 miles, and references to the transportation of timber over long distances are not uncommon in Pueblo traditions. In De Chelly great difficulty must have been experienced in procuring an adequate supply, as in that portion of the canyon where most of the ruins occur no suitable trees grow. Doubtless in many cases, where the location under overhanging cliffs permitted, roofs were dispensed with, but this alone would not account for the dearth of timber found in the ruins. If we suppose the canyon to have been the scene of a number of occupancies instead of one, the absence of timber work, as well as the much obliterated appearance of some of the ruins, would be explained, for the material would be used more than once, perhaps several times. The Navaho would not use the timber in cliff ruins under any circumstances, and they would rather starve than eat food cooked with it. Many of the cliff outlooks, being occupied only during the farming season and being also fairly well sheltered, were probably roofless.

Timber was used as an aid to masonry construction in two ways—as a foundation and as a tie. Many instances can be seen where the walls rest on beams, running, not with them, but across them. These beams were placed directly on the rock, and the front walls rested partly on their ends and partly on the rock itself. Plate LII shows the end of one of these beams. In nine cases out of ten the beams do not appear to have served any useful end, but perhaps if the walls were removed down to the foundations the purpose would be clear. Sometimes a beam was placed on the rock in the line of the wall above it. The single or separate room occupying the western end of the upper cave in the Casa Blanca ruin is an example of this use. The front wall rests on beams, as shown in plate XLVI. Some of the back adobe walls in the eastern part of the upper ruin rest on timbers, and instances of this feature are not uncommon in other parts of the canyon. The southeastern corner of the tower in Mummy Cave ruin in Del Muerto rested on timbers apparently laid over a small cavity or hole in the rock. The timber was not strong enough to support the weight placed upon it, and consequently gave way, letting the corner of the tower fall out.

Cross walls were sometimes tied to front or back walls by timbers built into them, but this method, of which fine examples can be seen in the Chaco ruins, was but slightly practiced here. Timber was used also to prevent the slipping of walls on sloping sites, being placed vertically and built into the masonry; but as this use is a constructive expedient it is discussed under that head.

STORAGE AND BURIAL CISTS

Facilities for the storage of grain and other produce are essential in the pueblo system of horticulture, as in any other. As a result, storage cists are found everywhere. In the modern pueblos the inner

PLASTERED WALL IN CANYON DE CHELLY

dark rooms, which would otherwise be useless, provide the necessary space, but in the settlements in De Chelly, which were very small as a rule, there were few such rooms, and special structures had to be erected. These differed from the dwelling rooms only in size, although as a rule, perhaps, the openings by which they were entered were not so large as those of the dwellings and were sometimes, possibly always, provided with some means by which they could be closed.

Immense numbers of these storage cists are found in the canyon, some of them with masonry so roughly executed that it is difficult to discriminate between the old pueblo and the modern Navaho work. Sometimes these cists or small rooms form part of a village, more often they are attached to the cliff outlooks, and not infrequently they stand alone on sites overlooking the lands whose product they contained. It is probable that many of the cliff outlooks themselves were used quite as much for temporary storage as for habitations during the farming season. These two uses, although quite distinct, do not conflict with each other. Doubtless many excellent sites, now marked only by the remains of storage cists, were occupied also during the summer as outlooks without the erection of any house structures. Some of the modern pueblos now use temporary shelters of brush for outlooks.

It is not meant that the crops when gathered were placed in these cists and kept there until used. The harvest was, as a rule, permanently stored in the home villages, and the cists were used only for temporary storage. Doubtless the old practice resembled somewhat that followed by the Navaho today. The harvest is gathered at the proper time and what is not eaten at once is hidden away in cists of old or modern construction. If it is well hidden, the grain may remain in the cists for a long time if not withdrawn for consumption; but as a rule it is taken away a few months later. The annual emigration of the Navaho commences soon after the harvest, and at intervals during the winter and spring, and in summer, if the supply is not then exhausted, visits are paid to the cists and portions of the grain are carried away.

A large proportion of the cists are of modern Navaho work, but that some of them were used by the pueblo people who preceded them seems probable from the similarity in horticultural methods, and from the small size of many of the villages. A village inhabited by half a dozen people was not uncommon; one which could accommodate more than fifty was rare. Moreover, some of the storage cists that occur in conjunction with dwellings differ from the latter only in size and in their separation from the other rooms. The masonry is quite as good as that of the houses, and much superior to the Navaho work.

Plate LXI shows an example which occurs in the lower part of the canyon, at the point marked 1 on the map. It is placed on a little ledge or block of rock, 12 feet above the stream and about 8 feet above the bottom land below it. This is the first considerable area of bottom land in the canyon. The cist is 2 feet square inside and occupies the

whole width of the rock. An exceptionally large amount of mud plaster was used on the walls, which are better finished outside than inside. Access was had by hand-holes in the rock, now almost obliterated. Originally the structure consisted of two or more rooms.

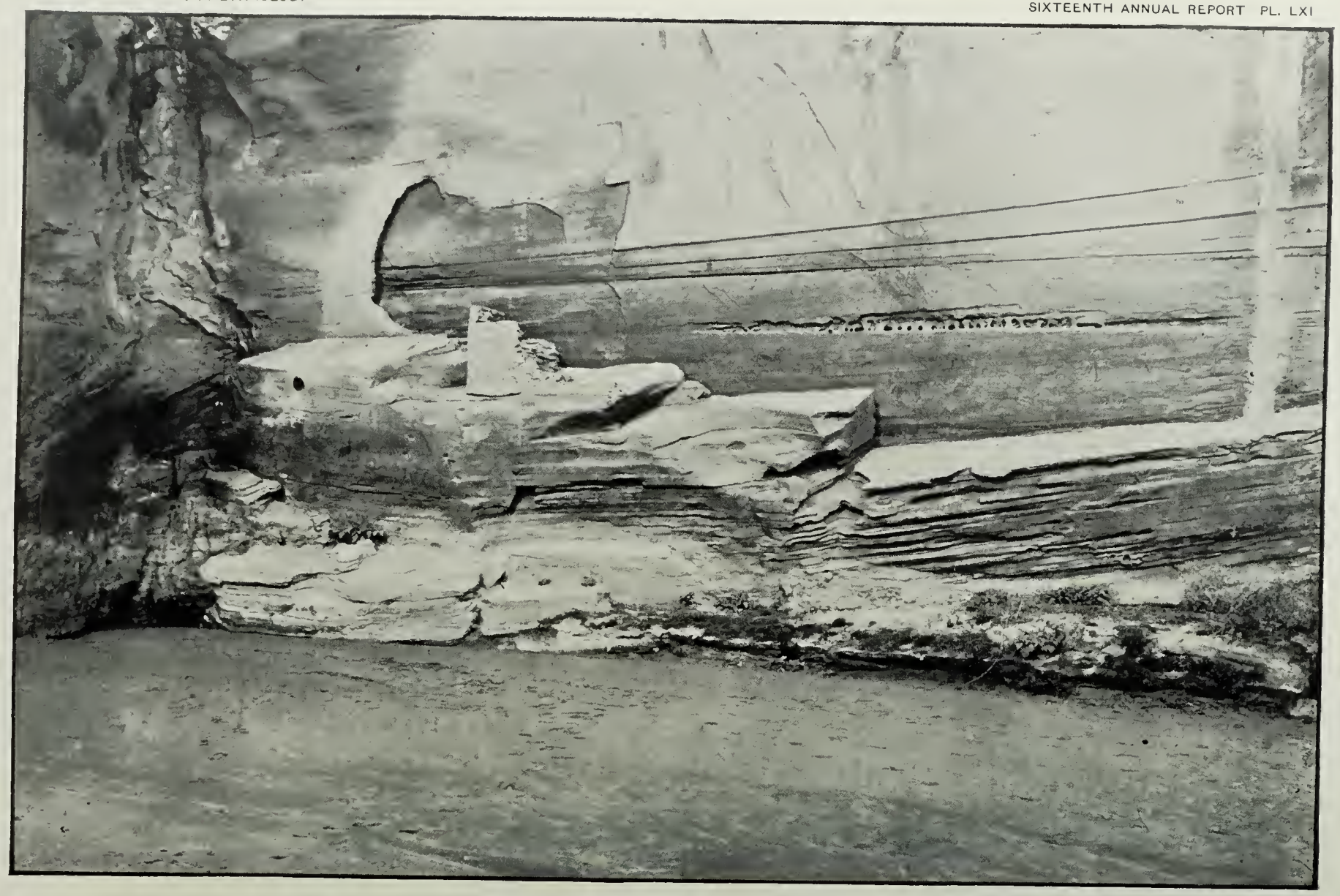
A little below this site there are some well-executed pictographs, and on some rocks immediately to the right some crude work of the Navaho of the same sort. To the left of the cist a round hole 6 or 8 inches in diameter has been pecked into the almost vertical face of the rock. The purpose of this is not clear.

The storage of water was so seldom attempted, or perhaps so seldom necessary, that only one example of a reservoir was found. This has already been described (page 126). If the cliff ruins were defensive structures, a supply of water must have been kept in them, and where this requirement was common, as it would be under the hypothesis, certainly some receptacle other than jars of pottery would be provided. Few, if any, of the cliff outlooks are so situated that a supply of water could be procured without descending to the stream bed, and without a supply of water the most impregnable site in the canyon would have little value.

The number of burial cists in the canyon is remarkable; there are hundreds of them. Practically every ruin whose walls are still standing contains one or more, some have eight or ten. They are all of Navaho origin and in many of them the remains of Navaho dead may still be seen. Possibly the Navaho taboo of their own dead has brought about the partial taboo of the cliff dwellers' remains which prevails, and which is an element that must be taken into account in any discussion of the antiquity of the ruins.

The burial cists are built usually in a corner or against a wall of a cliff dweller's house, but sometimes they are built against a cliff wall, and occasionally stand out alone. The masonry is always rough, much inferior to the old walls against which it generally rests, and usually very flimsy. The structures are dome-shape when standing alone, or in the shape of a section of a dome when placed against other walls. The natural bedding of the stone is sometimes wholly ignored, and in some cases the walls consist merely of thin slabs of stone on edge, held together with masses of mud, the whole presenting an average thickness of less than 3 inches. Such structures on ordinary sites would not last six months; protected as they are they might last for many years.

Not all the Navaho dead in the canyon find their last resting place in the ruins. Graves can be seen under bowlders and rocks high up on the talus; and in one place in De Chelly a number of little piles of stones are pointed out as the burial places of "many Americans," who, it is said, were killed by the Navaho in their last war. It is also said that in the olden days, when the Navaho considered De Chelly their stronghold and the heart of their country, the remains of prominent



STORAGE CIST IN CANYON DE CHELLY

men of the tribe were often brought to the canyon for interment in the ruins. Such burials are still made, both in the ruins themselves and in cists on similar sites.

As a whole the Navaho burial cists are much more difficult of access than the ruins, and some of them appear to be now really inaccessible, a statement which can be made of but few ruins. Some of them appear to have been reached from above. The agility and dexterity of the Navaho in climbing the cliffs is remarkable, and possibly some of the sites now apparently inaccessible are not so considered by them. As before stated, there are a number of Navaho foot trails out of the canyon, where shallow pits or holes have been pecked in the rock as an aid in the more difficult places, and similar aids were often employed to afford access to storage and burial cists. Plate LVI shows a

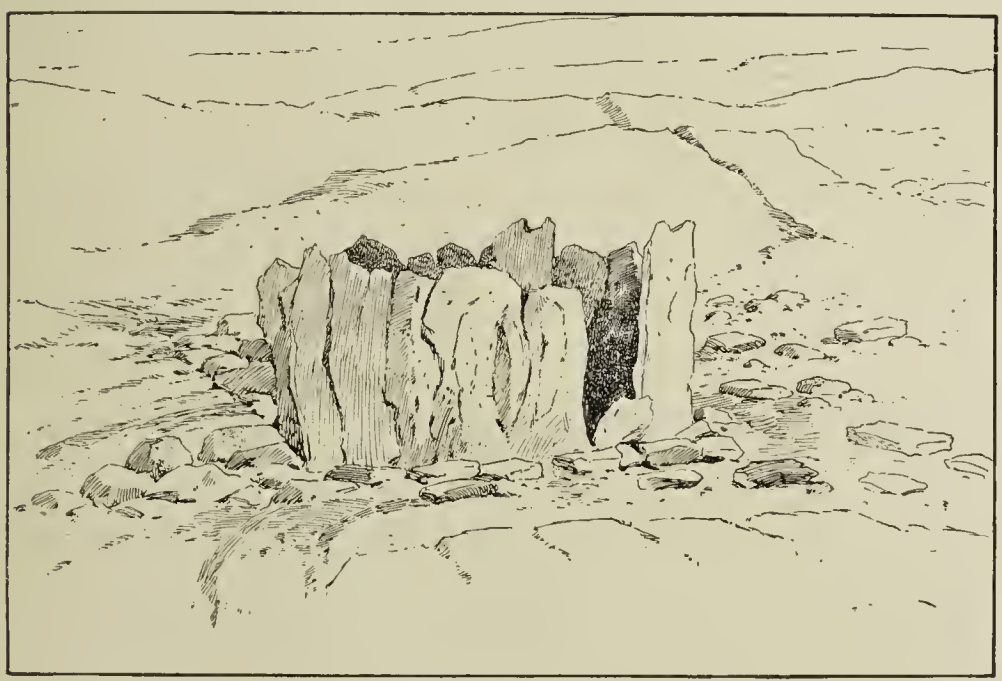


FIG. 68—Cist composed of upright slabs.

site in the lower part of the canyon where such means have been employed. The pits in the rock are so much worn by atmospheric erosion that the ascent now is very dangerous. The cove or ledge to which they lead is about halfway up the cliff, and on it are a number of cists, one of them still intact, with a doorway. The masonry consists of large slabs of sandstone set on edge, sometimes irregularly one above another, the whole being roughly plastered inside and out. About 200 yards farther up the cove, on the same side, there is a series of foot holes leading to a small cave about halfway up, and thence upward and probably out of the canyon. They are probably of Navaho origin.

The use of stone on edge is apparently confined to these cists. Figure 68 shows a structure which occurs a little above the ruin marked 37 on the map. The walls consist of thin slabs of stone set upright and

roughly plastered where they meet. Instances of the use of stone in this way are not uncommon in the pueblo country, and there are a number of examples in De Chelly.

As before stated, the typical Navaho burial cist is of dome shape. The roof or upper portion is supported on sticks so arranged as to leave a small square opening in the top. Apparently at some stage in its existence this hole is closed and sealed, but examples were examined which were very old and one which was but twenty-four hours old, but in neither case was the opening closed. Doubtless the opening has some ceremonial significance; it is not of any actual use, as it is too small to permit the passage of a human body. Plate LXII shows a typical cist in good order and another such broken down. These examples occur at the point marked 6 on the map, in the ruin shown in plate LIII. This site is of comparatively easy access, and there are many others equally easy or even more so, but, on the other hand, there are many sites which now seem to be wholly inaccessible.

DEFENSIVE AND CONSTRUCTIVE EXPEDIENTS

The cliff ruins have always been regarded as defensive structures, sometimes even as fortresses, but in De Chelly whatever value they have in this respect is due solely to the sites they occupy. There are many places here where slight defensive works on the approaches to sites would increase their value a hundredfold, but such works were apparently never constructed. Furthermore, the ruins themselves never show even a suggestion of the influence of the defensive motive, except in the two possible instances already mentioned. The ordinary or dwelling-house plan has not been at all modified, not even to the extent that it has in the modern pueblos. If the cliff ruins were defensive structures it would certainly seem that an influence strong enough to bring about the occupancy of such inconvenient and unsuitable sites would also be strong enough to bring about some modifications in the architecture, modifications which would render more suitable sites available. The influence of the physical environment on pueblo architecture, and the sensitiveness of the latter to such influence, has already been commented on. Moreover, it also has been stated that, so far as known, but one instance occurs in the canyon where provision was made for the storage of water; yet without water the strongest "fortress" in the canyon could not withstand a siege of forty-eight hours. Further, assuming that the structures were defensive, and well prepared to resist attack, if necessary, for several days, only a few such attacks would be required to cause their abandonment, for the crops on the canyon bottom, practically the sole possessions of the dwellers in the canyon, would necessarily be lost.

These are some of the difficulties that stand in the way of the assumption that the cliff ruins were defensive structures or permanent homes. If, however, we adopt the hypothesis that they were farming outlooks

NAVAHO BURIAL CISTS

occupied only during the farming season, and then only for a few days or weeks at a time, after the manner that such outlooks are used by the Pueblo Indians at the present time, most of the difficulties vanish.

The apparent inaccessibility of many of the sites disappears on close examination, and we must not forget that places really difficult of access to us would not necessarily be so regarded by a people accustomed to that manner of life. Many locations which could not be surpassed as defensive sites were not occupied, while others much inferior in this respect were built upon. It was very seldom that the natural conditions were modified, even to the extent of selecting a route of access other than that which would naturally be followed, and, of course, the easiest route for the cliff dwellers would be also the easiest route for their enemies. In many cases the easiest way of access, which was the one used by the cliff dwellers, was not direct. It was not commanded by the immediate site of the dwellings, except in its upper part, and in some cases not at all. Enemies could climb to the very doors of the houses before they could be seen or attacked. The absence of military knowledge and skill, and of any attempt to fortify or strengthen a site, or even to fully utilize its natural defensive advantages, is characteristic of the cliff ruins of De Chelly. If the cliff dwellers were driven to the use of such places by a necessity for defense, this absence is remarkable, especially as there is evidence that the settlements were occupied for a number of, perhaps a great many, years.

Under the head of constructive expedients we have a different result. The difficulties which came from the occupancy of exceptional sites were promptly reflected in the construction, and unusual ways and methods were adopted to overcome them. These methods are the more interesting in that they were not always successful. It sometimes happened that walls had to be placed on a foundation of smooth, sloping rock. In such cases the rock was never cut away, but timbers were employed to hold the wall in place. In some instances the timbers were laid at right angles to the line of front wall, at points where cross walls joined it inside. The front wall thus rested partly on the ends of timbers and partly on rock, while the other ends of the timbers were held in place by the cross walls built upon them. An example of this construction is shown in plate LII. In other instances, where the surface was irregular but did not slope much, timbers were laid on the wall lines and the masonry rested partly upon them. An example of this occurs in the Casa Blanca ruin, shown in plate XLVII. Still another method of using timber in masonry occurs in a number of ruins. It was seldom effective and apparently was confined to this region. This consists of the incorporation into the masonry of upright logs. Figure 69 shows an example that occurs at the point marked 32 on the map. The site here is an especially difficult one, as the builders were compelled to place walls not only on sloping rock foundations, but also on loose débris, and the vertical timber support is quite common.

The three kivas which are shown on the plan occupied the front of the village, and their front walls have fallen out. Apparently the same accident has happened at least once, if not several times, before, and a fragment of a previous front wall has slipped down 3 or 4 feet, and was left there when the kiva was repaired. The round dots shown on the plan, two in the wall of the central kiva and one on the east, represent vertical timbers incorporated in the masonry. The tops of these logs reach the level of the top of the bench in the kiva, and their lower ends rest in cavities in the rocks. The eastern one was removed and was found to be about 2 feet long. The upper half was charred, although formerly inclosed completely in the masonry, as though it had been burned off to the required length. The lower end was hacked off with some blunt implement, and as nearly squared as it could be done with such means. It was set into a socket or hole pecked in the solid rock

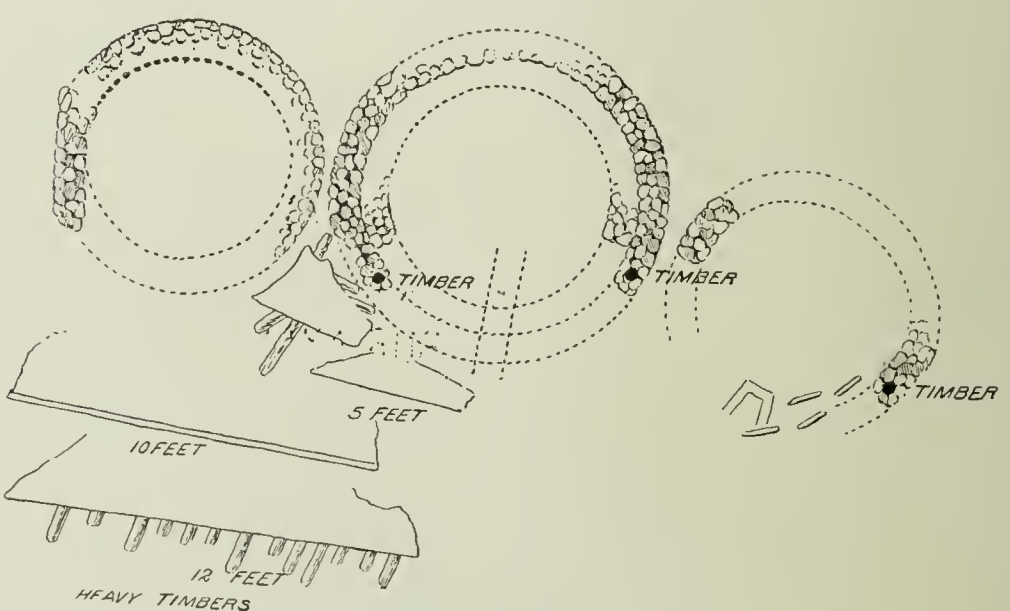


FIG. 69—Retaining walls in Canyon de Chelly.

and plastered in with clay. In the outer portion of the eastern wall of the central kiva there are many marks of sticks, 3 to 4 inches in diameter and placed vertically.

Although timbers as an aid to masonry occur in many ruins, they predominate in those which have been suggested as the sites most recently occupied; but in the Chaco ruins timber has been used extensively and much more skillfully than here. Instances occur where a cross wall has been tied into a front wall with timber, and so effective was the device that in one instance a considerable section of cross wall can be seen suspended in the air, being completely broken out below and now supported wholly by the ties. Instances can also be seen where partition walls are supported on crossbeams at some distance from the ground, forming large and convenient openings between rooms; but nothing of that kind was seen in De Chelly. In the latter region

KIVA IN RUIN No. 10, SHOWING SECOND-STORY WALLS

wherever horizontal timbers are used for the support of masonry they rest on the bed rock.

The same ruin (No. 32) contains an elaborate system of retaining walls, which are shown partly in figure 69. At first a retaining wall was built immediately in front of the main kiva, which is now 5 feet high outside. Apparently this did not serve the purpose intended, for another and much heavier wall was built immediately next to it. This wall is 4 feet thick, flush on top and inside, but 10 feet high outside. At half its height it has a step back of 6 inches. It would seem that even this heavy construction did not suffice, and still another wall was built outside of and next to it. This wall is nearly or quite as heavy as the one described, and its top is on the level of the foot of that wall, but it is 12 feet high outside. Something of the character of the site may be inferred from the arrangement of these walls, which have a combined vertical fall of 27 feet in a horizontal distance of less than 15 feet. The outer or lower wall has a series of very heavy timbers projecting from its face; these are placed irregularly. It should be noted that access to this village was from the bench on either side, and that it could not be reached from the front, where these walls occur. There are other walls on the lower slope, similarly reinforced.

A little to the right of the point where these retaining walls occur there is a room in which horizontal beams have been incorporated in the masonry. A similar use of timber occurs in ruin No. 16 and is shown in plate LX. Why timber should be used in this way is not clear. It may be that when the supply was placed on the ground the builders found that they had more timber than was needed for a roof and used the excess in the wall rather than bring up more stone. The posts which were placed vertically and built into the wall were always short; perhaps they were fragments or ends cut from roofing timbers that were found to be too long. In many instances they failed to hold the walls, and possibly the pit holes in sloping rock, which are numerous on some sites, indicate places where this expedient was formerly employed.

It is singular that the necessity for such expedients did not develop the idea of a buttress. On this site such an expedient would have saved an immense amount of work. In only one place in the canyon was a buttress found. This was in the Casa Blanca ruin, shown in plate XLVII. There is no doubt that in this place the buttress was used with a full knowledge of its principles, and but little doubt that the idea was imported at a late, perhaps the latest, period in the occupancy of that site. Had it been known before, it would have been used in other places where there was great need for it, not so much to prevent the slipping of walls as to supersede the construction of walls 4 feet thick or more, and to strengthen outside walls which were likely to give way at any time from the outward thrust upon them.

Altogether the constructive expedients employed in De Chelly suggest the introduction of plans and methods adapted to other regions

and other conditions into a new region with different requirements, and that occupancy of the latter region did not continue long enough to conform the methods to the new conditions.

KIVAS OR SACRED CHAMBERS

The kivas, or estufas as they formerly were called, are sacred chambers in which the civil and religious affairs of the tribe are transacted, and they also form a place of resort, or club, as it were, for the men. Their functions are many and varied, but as this subject has already been discussed at length[1] it need not be enlarged upon here. In Tusayan the kivas are rectangular and separated from the houses; in Zuñi and in some other pueblos they are also rectangular, but are incorporated in the house clusters—a feature doubtless brought about by the repressive policy of the Spanish monks. In some of the pueblos, as in Taos, they are circular, and in many of the older ruins the same form is found. In the large ruins of Chaco canyon the kivas occur in groups arranged along the inner side of the rooms; always, where the ground plan is such as to permit it, arranged on the border of an inner court. In Canyon de Chelly the kivas are always circular and are placed generally on the outer edge of the settlement, which is usually the front.

As the function of the kivas is principally a religious one, they are found only in permanent villages where religious ceremonies were performed. They are never found in subordinate settlements, or farming villages, or outlooks, unless such settlements came to be inhabited all the year—in other words, until they became permanent villages. The habits and requirements of the Pueblo people make it essential that a permanent village should have one or more kivas, and we have in the presence of these structures a criterion by which the character of a village or ruin may be determined. As the kivas in De Chelly are always circular, they can generally be easily distinguished.

The circular kiva is unquestionably a survival in architecture—a relic of the time when the Pueblo people dwelt in circular lodges or huts—and its use in conjunction with a rectangular system entailed many difficulties and some awkward expedients to overcome them. The main problem, how to use the two systems together, was solved by inclosing the circular chamber in a rectangular cell, and this expedient aided in the solution of the hardly less important problem of roofing. The roof of the kiva was the roof of the chamber that inclosed it.

It seems to have been a common requirement throughout the pueblo country that the kiva should be wholly or partly underground. So strong was this requirement in Tusayan that the occurrence of natural clefts and fissures in the rock of the mesa top has dictated the location of the kivas often at some distance from the houses. But in De Chelly there were some sites where the requirement could not be filled without extensive rock excavation wholly beyond the power of the builders.

[1] 8th Ann. Rept. Bur. Eth., "A study of Pueblo architecture in Tusayan and Cibola," by Victor Mindeleff; Washington, 1891.

Here then it seems that other requirements were strong enough to overcome the ceremonial necessity for partly subterranean structures, for examples of that kind are comparatively rare. In all of the ruins on the canyon bottom the requirement could be filled, and as many of the villages on defensive sites were constructed after the site itself had been partly filled up with loose débris, it could also be filled in those cases. There are also instances where the bottom of the kiva rests directly on the rock, while outside the walls the site was covered deep with artificial débris. But it would be difficult to determine what was the surface of the ground when the kiva was in use.

The size and character of the kivas in De Chelly, and their relations to the other rooms about them, are shown in the ground plans preceding. Some have walls still standing to a height of 6 feet above the ground, but this could not have been the total height. Dr H. C. Yarrow, U. S. A., in 1874 examined one of the five large circular kivas in Taos. He states[1] that it was 25 or 30 feet in diameter, arched above, and 20 feet high. Around the wall, 2 feet from the ground, there was a hard earthen bench, and in the center a fireplace about 2 by 3 feet.

Entrance to the kivas is invariably from the roof by a ladder. This appears to be a ceremonial requirement. Doorways at the ground level are not only unknown, but also impracticable; but in De Chelly there are some puzzling features which might easily be mistaken for such doorways. The principal kiva in the ruin, which occurs at the point marked 10 on the map, and described above (page 123, figure 24), is on the edge of the ledge, and its outer wall is so close as to make a passage difficult, although not impossible. At the point where the curved wall comes nearest the cliff there is a narrow gap or opening, not more than 15 inches wide. In front of this there appears to be a little platform on the sloping rock, 2 feet long, 10 inches wide, and now about a foot high. At first sight this would be taken for a doorway so arranged that access to the kiva could be obtained only from below; but a closer examination shows that this was probably only what remains of a chimney-like structure, such as those described later.

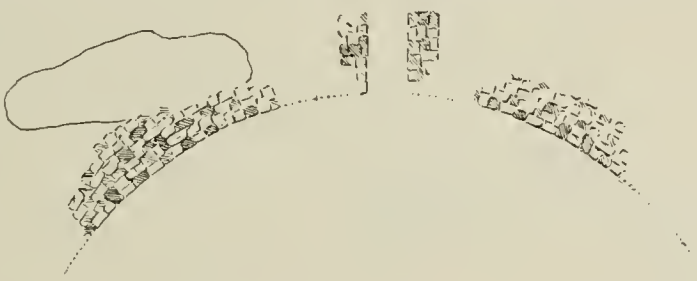


FIG. 70—Part of a kiva in ruin No. 31.

In ruin 31 there is another example. The kiva here was about 20 feet in diameter, with rather thin walls smoothly plastered inside. On the inner side the walls are from 3 to 5 feet high; outside they are generally flush with the ground. The kiva is not a true circle, but is slightly elongated north and south. On the south side, nearest the edge of the ledge, there is an opening, shown in figure 70. The opening is 6 feet 3 inches

[1] Wheeler Survey Reports, vol. VII, Archæology, p. 327.

wide, and the ends of the curved walls terminate in smoothly finished surfaces. In front of it there are remains of two walls, about a foot apart, and so arranged as to form an apparent passageway into the interior of the kiva. These seem to be a kind of platform, like that just described, but close inspection shows the walls, which can be traced to within 6 inches of the inner wall of the kiva. This also may be the remains of a chimney-like structure. There are other points in the canyon where the same feature occurs, but in none of them is the evidence of an opening or doorway more definite than in the examples described.

The masonry of the kivas is always as good as that of any other structure on the site, and generally much better. The walls are usually massive; sometimes they are 3 feet thick in the upper part and 4 feet in the lower portion, where the bench occurs. In a few cases the kiva has an upper or second story, but when this occurs no attempt is made to preserve the circular form, and the upper rooms are really rectangular with much rounded corners. Plate XLIX shows a second-story kiva wall in Mummy Cave ruin, and plate LXIII one in ruin No. 10 in De Chelly. The latter occurs over the principal kiva, and the walls which are still standing on the north and west sides are approximately straight, but the corners are much rounded. Figure 71 is a detailed plan of part of the kiva, showing the arrangement of the upper walls. The kiva walls are about 18 inches thick. On the north side the upper wall is supported by a heavy beam, part of which is still in place. Under the northeast corner of the upper room there is a little triangular space formed by a short connecting wall, shown on the plan. This is really a flying wall, covering only the upper portion of the space, and its purpose is not clear, as the opening left is not large enough to permit the passage of a person, and was available only from the second story.

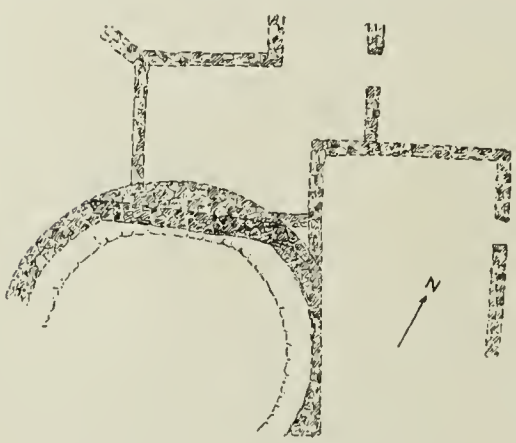


FIG. 71—Plan of part of a kiva in ruin No. 10.

Apparently the greatest care was bestowed on the construction and finish of the kivas. The exterior of the circular wall is often rough and unfinished, but this is probably because the whole structure was generally inclosed within rectangular walls. The interior was plastered, often with a number of coats. The southern kiva in ruin No. 10 shows a number of these on its interior surface, applied one after another, and now forming a plastering nearly three-quarters of an inch thick. In its section 18 distinct coats can be counted, separated one from the other by a thin film of smoke-blackened surface. The kiva in ruin No. 16 has 4 or 5 coats, that in ruin No. 31 shows at least 8. In the last example the last coat was not decorated, but some of the underlying ones were.

Kivas are used principally in the autumn and winter, when the farming season is over and the ceremonies and dances take place. It is probable, therefore, that each coat of plaster means at least a year in the history of the kiva, which would indicate that some of the sites were occupied about twenty years. But Mr Frank H. Cushing has observed in Zuñi a ceremony, part of which is the refinishing of the kiva interior, and this occurs only once in four years. This would give a maximum occupancy of about eighty years to some of the kivas; the ruins as a whole would hardly justify an hypothesis of a longer occupancy than this. In Tusayan the interior of the kiva is plastered by the women once every year at the feast of Powamu (the fructifying moon).

The kivas are seldom true circles, being usually elongated one way or another. Some instances occur which are rectangular, such as the room shown in figure 19, which was apparently a kiva. Nordenskiöld[1] illustrates an example which appears to have been oval by design,

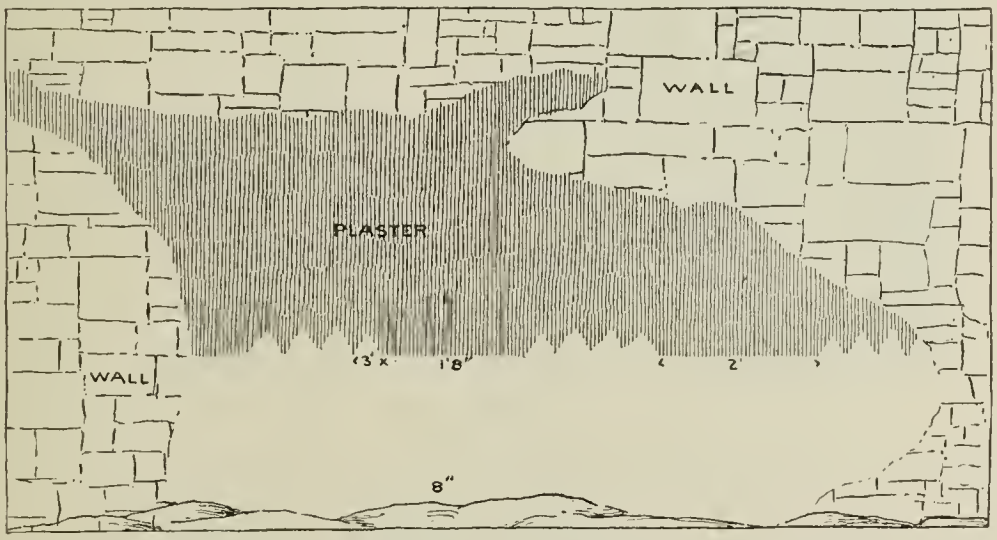


FIG. 72—Kiva decoration in white.

differing in this respect from anything found in De Chelly. Most of the kivas have an interior bench, about a foot wide and 2 feet above the floor. This bench is sometimes continuous around the whole interior, sometimes extends only partly around. Wherever the chimney-like structure is attached to a kiva the bench is omitted or broken at that point. The kiva wall on the floor level is always continuous except before the chimney-like feature. The most elaborate system of benches and buttresses seen in the canyon occurs in the principal kiva of the Mummy Cave ruin. This is shown in the ground plan, figure 16, and also in figures 82 and 83. In the ruins of the Mancos, Nordenskiöld found kivas in which this feature is carried much further. He illustrates[2] an example with a complete bench regularly divided into six equal parts by an equal number of buttresses or pillars (properly pilasters) extending out flush with the front of the bench. This is said

[1] Cliff Dwellers of the Mesa Verde, p. 63, fig. 36.

[2] Loc. cit., figs. 6 and 7, pp. 15–16.

to be a typical example, to which practically all the kivas conform. It has also the chimney-like structure, to be described later. Like the rectangular kivas of Tusayan the circular structures of De Chelly have little niches in the walls. Probably these were places of deposit for certain paraphernalia used in the ceremonies.

FIG. 73—Pictograph in white.

Some of the kivas have an interior decoration consisting of a band with points. Figure 72 shows an example that occurs in ruin No. 10 in De Chelly, in the north kiva. The band, done in white, is about 18 inches below the bench, and its top is broken at intervals into groups of points rising from it, four points in each group. In the north kiva the interior wall is decorated by a series of vertical bands in white. One series occurs on the vertical face of the bench; the bands are 2 inches wide and 8 inches apart. Another series occurs on the wall, and consists of bands $2\frac{1}{2}$ to 3 inches wide, about 2 feet high and 12 to 14 inches apart. The bands were observed only on the southern and western sides of the kiva, but originally there may have been others on the north and east.

FIG. 74—Markings on cliff wall, ruin No. 37.

In ruin No. 4 there is a similar series of bars, but in this instance they occur on the cliff wall back of the rooms. They are shown in figure 73.

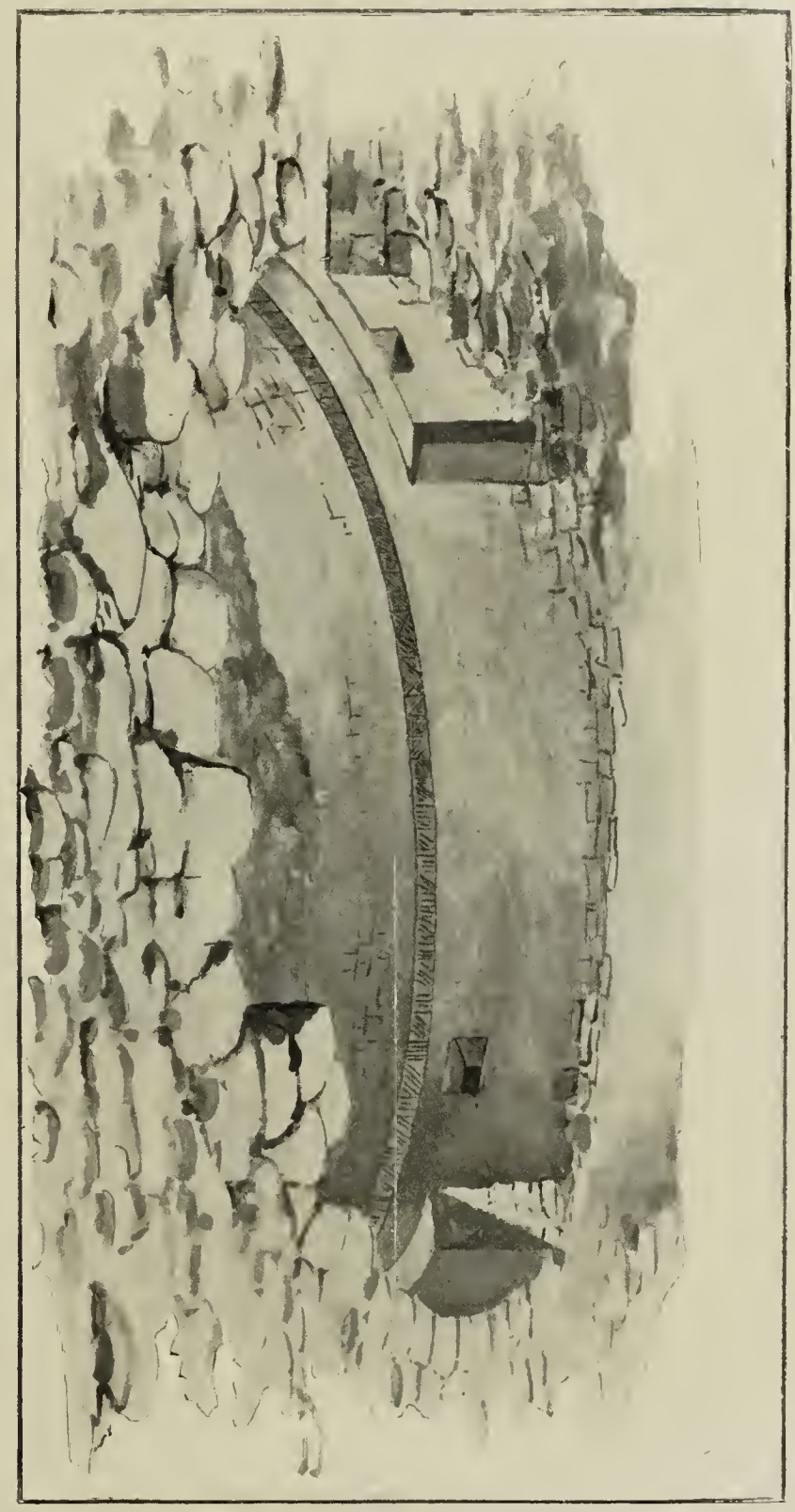


Fig. 75.—Decorative band in kiva in Mummy Cave ruin.

FIG. 76—Design employed in decorative band.

There are four bars or upright bands, done in white paint, and surmounted by four round dots or spots. To the left of the four bars, level with their tops, there is a small triangle, also in white. The bars are 30 inches long and 4 inches wide. The upper dots are nearly 2 feet above the tops of the bars. It is evident that this figure was designed to be seen from a distance. Figure 74 shows some markings on the cliff wall back of ruin No. 37.

Examples almost identical with those shown here are abundant in the Mancos ruins. It is probable that they are of ceremonial rather than of decorative origin, and in this connection it may be stated that Mr Frank H. Cushing has observed in Zuñi the ceremony of marking the sides of a kiva hatchway with white bars closely resembling those shown in figure 73. This ceremony occurs once in four years, and the purpose of the marks is said to be to indicate the cardinal directions. In the ceremonials of the Pueblo Indians it is necessary to know where the cardinal points are; a prayer, for instance, is often addressed to the north, west, south, and east, and when such ceremonials were performed in a circular chamber some means by which the direction could be determined was essential.

In the principal kiva in Mummy Cave ruin, however, there is a painted band on the front of the bench which appears to be really an attempt at decoration. Over the white there is a band 4 or 5 inches wide, consisting of a meander done in red. This is shown in figure 75, and in detail in figure 76. The design is similar to that used today. Its importance arises not so much from this as from the fact that it is difficult to regard this as other than ornamentation, and the Pueblo architect had not yet reached the stage of ornamented construction. The ruins in the Mancos canyon and the Mesa Verde country obviously represent a later stage in development than those in De Chelly, yet nowhere in that region do we find the counterpart of the decoration in Mummy Cave kiva. Bands with points occur, sometimes on walls of rectangular rooms. One such is illustrated by Chapin,[1] who also shows a variety of the meander, treated, however, as a pictograph and

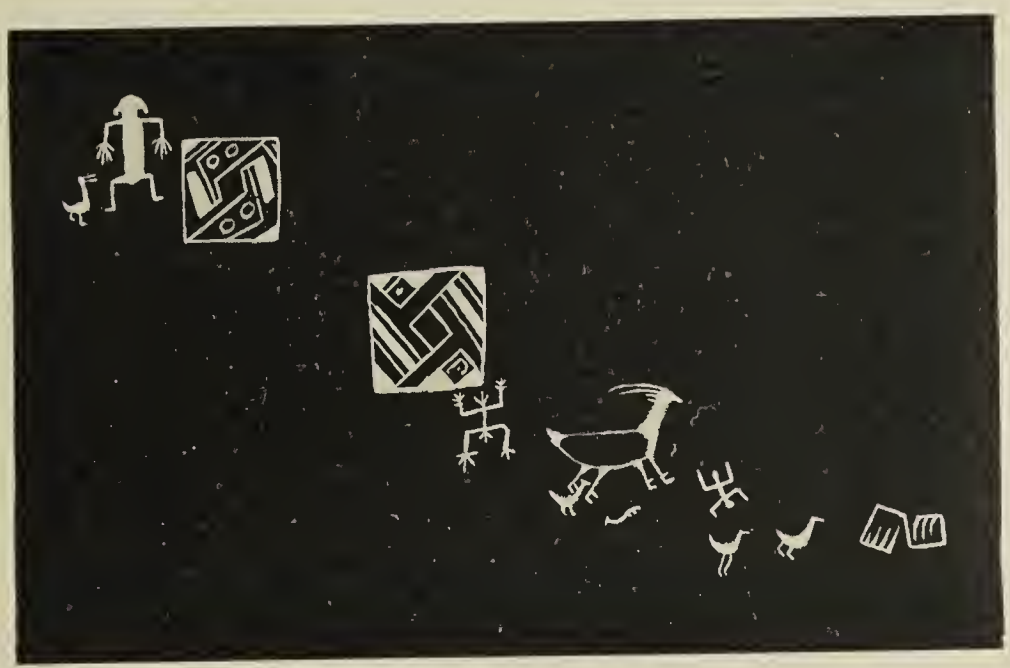


FIG. 77—Pictographs in Canyon de Chelly.

without reference to its decorative value. Similar bands are shown also by Nordenskiöld,[2] but always with three points, instead of four, which were done in red. Figure 77 shows some pictographs somewhat resembling the Mancos examples. These occur at the point marked 1 on the map, in connection with a small storage cist already described.

No kiva has been found in De Chelly with a roof in place. Nearly all of them are inclosed in rectangular chambers, and it seems more than probable that the roofing of the kiva was simply the roofing of the inclosing chamber. As a rule the inclosing rectangular walls were erected at the same time as the kiva proper, and the outside of the inner circular wall was not finished at all. In a few instances the space

[1] Land of the Cliff Dwellers, illustration, pp. 143, 152.
[2] Cliff Dwellers of the Mesa Verde, figs. 6, 7, 76, 77, and 78.

between the outer rectangular and inner circular wall was filled in solid, or perhaps was so constructed, but usually the walls are separate and distinct.

CHIMNEY-LIKE STRUCTURES

There are peculiar structures found in some of the ruins, whose use and object are not clear. Reference has already been made to them in the descriptions of several ruins, and for want of a better name they have been designated chimney-like structures. At the time that they were examined they were supposed to be new, and the first hypothesis formed was that they were abortive chimneys, but further examination showed that this idea was not tenable. Subsequently Nordenskiöld's book on the Cliff Dwellers of the Mesa Verde was published, and it appears therefrom that this feature is very common in the region treated; so common as to constitute the type.

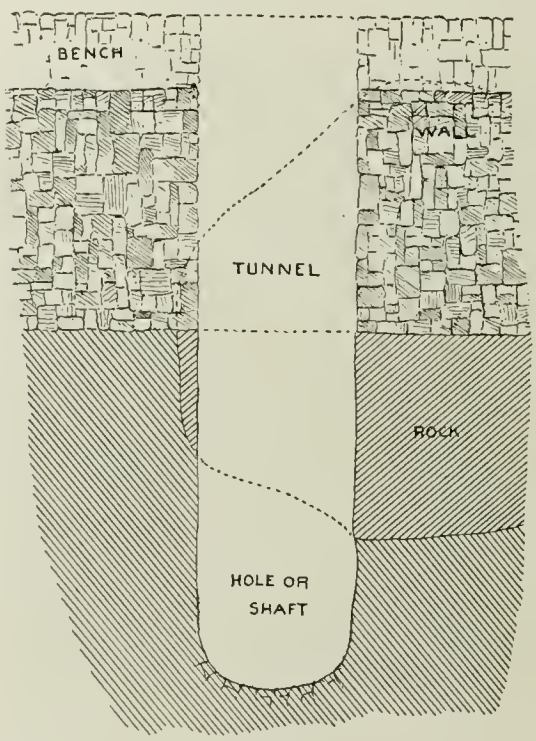


FIG. 78—Plan of chimney-like structure in ruin No. 15.

Figure 78 is a plan of one of these structures which occurs in ruin No. 15 in Canyon de Chelly. This ruin has already been described in detail (page 118). The chimney-like structure is attached to a rectangular room with rounded corners, which is supposed to have been a kiva, and which was two stories high. Excavation revealed the floor level about 7½ feet below where the roof was placed. In the center of the south wall there is an opening 1.5 feet high and eighty-five one-hundredths of a foot (10.2 inches) wide. The south wall is built over a large bowlder, and a tunnel or opening passes under this to a rounded vertical shaft, about a foot in diameter, which opens to the air. This perhaps is better shown in the section (figure 79). At first sight this would appear to be a chimney, but there are several objections to the idea. The interior of the shaft is not blackened by smoke, and while the tunnel is somewhat smoke-stained, the deposit is not so pronounced as on the walls of the room. The front of the tunnel in the room has a lintel composed of a single stick about an inch in diameter, as shown in the section. The roof of the tunnel was the underside of the large bowlder mentioned, and the stick lintel was of no use except to show that no fire could have been built under it. The

roof of the southern end of the tunnel, where it opens into the shaft, is considerably lower than at the other end. The floor of the tunnel and the sides were smoothly plastered, but the plastering does not appear to have been subjected to the action of fire.

The interior of the room, like the circular kivas already described, appears to have been plastered with a number of successive coats, all except the last being heavily stained by smoke. If the structure were a chimney, it was a dismal failure. The tunnel was made at the time the wall was erected, and passes under the bowlder over which the wall was built. A little east of the opening, inside the room, the bowlder shows through the wall, projecting slightly beyond its face.

Outside of the room the corner of the bowlder was chipped off, as shown on the plan, to permit the rounding of the shaft, the east, west, and south sides of which were built up with small pieces of stone, a

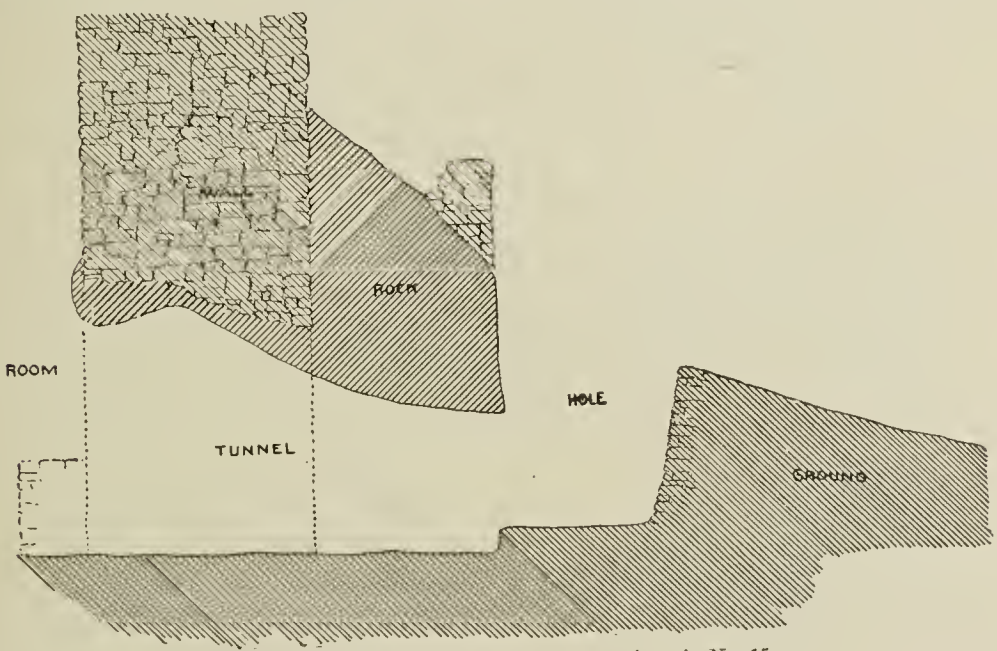


FIG. 79—Section of chimney-like structure in ruin No. 15.

kind of lining of masonry. There was also an outside structure of masonry, but how high above the ground it extended can not now be determined. A small fragment of this masonry is still left on the upper surface of the bowlder and is shown in the section.

Figure 80 is a plan of another example, which is attached to the circular kiva in ruin No. 16. This ruin is described on page 129. The kiva had an interior bench and the floor is 2 feet above its top. On the south side nearest the cliff edge the bench is interrupted to give place to a structure much like that described above. In this case, however, there was no convenient bowlder, and the roof of the tunnel has broken down so that the method of support can not be accurately determined. Probably it consisted of slabs of rock, as the span is small, and a number of large flat stones were removed from the tunnel in excavating.

The top of the tunnel is on the level of the top of the bench, as shown in figure 81, which is a vertical section. An inspection of the plan will show that the circular wall of the kiva is complete and that the inclosing rectangular wall was added later. The shaft was built at a still later period, and the line or junction marking its inner surface shows plainly in the interior of the tunnel. The general view of the ruin (plate LI) shows the exterior of the shaft, and the horizontal timbers on which the masonry is supported are shown in plate LII.

In front of the tunnel a flat piece of stone was placed on the floor, and in front of this again, about 2 feet from the mouth of the tunnel, there was an upright mass of masonry composed of stone and mud, and forming a curtain or screen before the opening. The original height of this structure was the same as that of the interior bench.

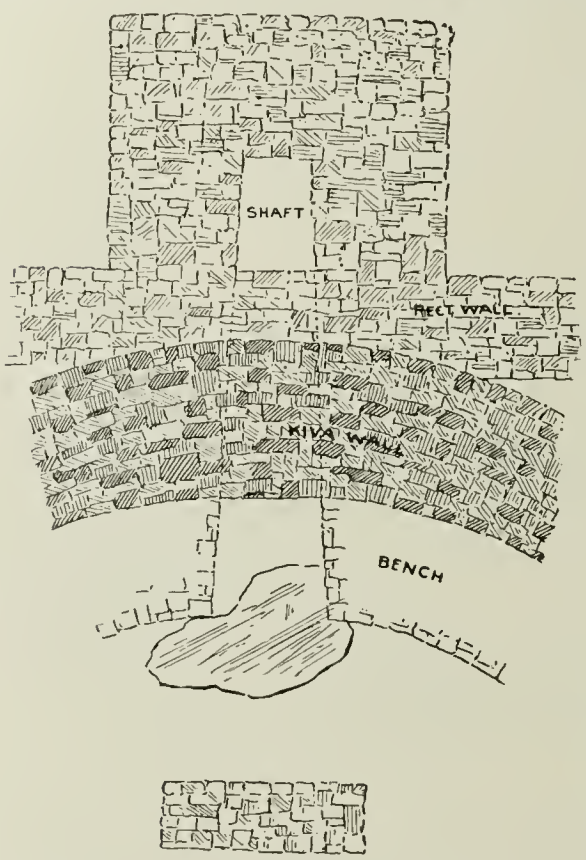


FIG. 80—Plan of chimney-like structure in ruin No. 16.

The inner surface of the rectangular inclosing wall is marked by a line in the interior of the tunnel. Inside of this line, toward the center of the kiva, the stones composing the wall are large; outside of it they are small. The interior plastering of the kiva is not smoke-blackened, but the coat next the surface is stained, as is also the third coat underneath. The interior of the tunnel is not much smoke-blackened, but it appears probable that part of its roof fell while the structure was still in use, as there are a number of little cavities in the masonry above its roof level filled with soot. A similar effect might result from leaks or cavities between the flat roofing stones. In excavating the tunnel a number of large lumps of clay were found in it, and there is no doubt that they formed part of the roof. Some of these had considerable quantities of grass mixed into them or stuck to the clay on one side. Apparently dry grass was used in the construction. A large fire could not have been built within the tunnel.

The principal kiva in Mummy Cave ruin has an elaborate structure of the kind under discussion. Figure 82 shows a plan of this kiva, of which a general view has already been given (figure 75). The bench

extended only partly around the interior, which had a continuous surface at the floor level, except on the southwest. At this point it is interrupted to give place to an elaborate chimney-like structure. Figure 83 is a general view.

The wall surface on the southern side of the kiva has been extended inward, as shown on the plan by a lighter shaded area. This was done at some period subsequent to the completion of the kiva, but whether it had any connection with the chimney-like structure could not be determined. The curtain or screen before the opening, which seems to be an invariable feature, is shown in both figures.

In this example the tunnel does not pass through the masonry as in those previously described, but occurs in the form of a covered trough, shown in the illustration with the covering removed. It occupies the middle third of a large recess in the main wall of the kiva, and is con-

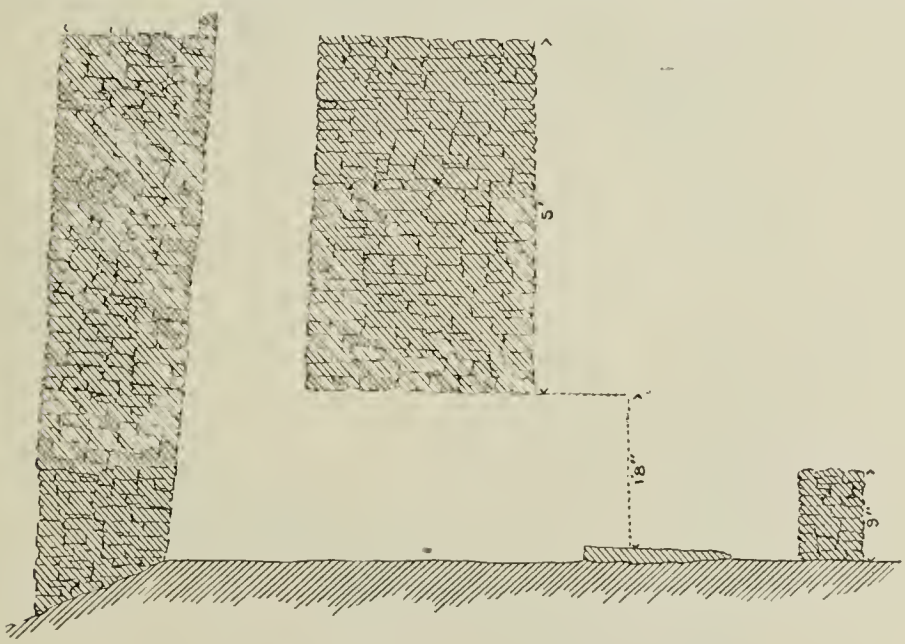


FIG. 81—Section of chimney-like structure in ruin No. 16.

nected at its outer end with a vertical square shaft about a foot wide. This shaft is separated from the recess above the bench level by a wall only a few inches thick, composed of a single layer of stones. That portion of it which is above the tunnel is supported by a single round stick of wood, as shown in figure 83. The south or inner opening of the tunnel is reduced to two-thirds of the width elsewhere by a framing composed of bundles of sticks bound together with withes and heavily coated with mud mortar. This was not placed flush with the inner face, but a few inches back, and the whole structure gives an effect of unusual neatness and good workmanship.

At various other points in the canyons examples of chimney-like structures occur, none, however, constructed on the elaborate plan of that last described. Two examples were found in the large rooms west of the tower in the central portion of Mummy Cave ruin, and these are

especially worthy of attention because they are attached to rectangular rooms, which there is no reason to suppose were kivas. The first room appears to have had a shaft only, without a niche or recess; the second room west of the tower had a recess and a rounded shaft, while the third room had neither recess nor shaft.

The usual form of this feature is that shown in figures 80 and 81, and consists only of a tunnel and shaft. There are not many examples in the canyons: altogether there may be a dozen now visible, but excavations in the village ruins would doubtless reveal others. Except the two in Mummy Cave ruin last mentioned, and some doubtful examples to be described later, they occur always as attachments to kivas, never to houses. Some of them, like the Mummy Cave example, were certainly built at the same time as the kivas, of which they formed a part; others were added to kivas after those structures had been completed and used.

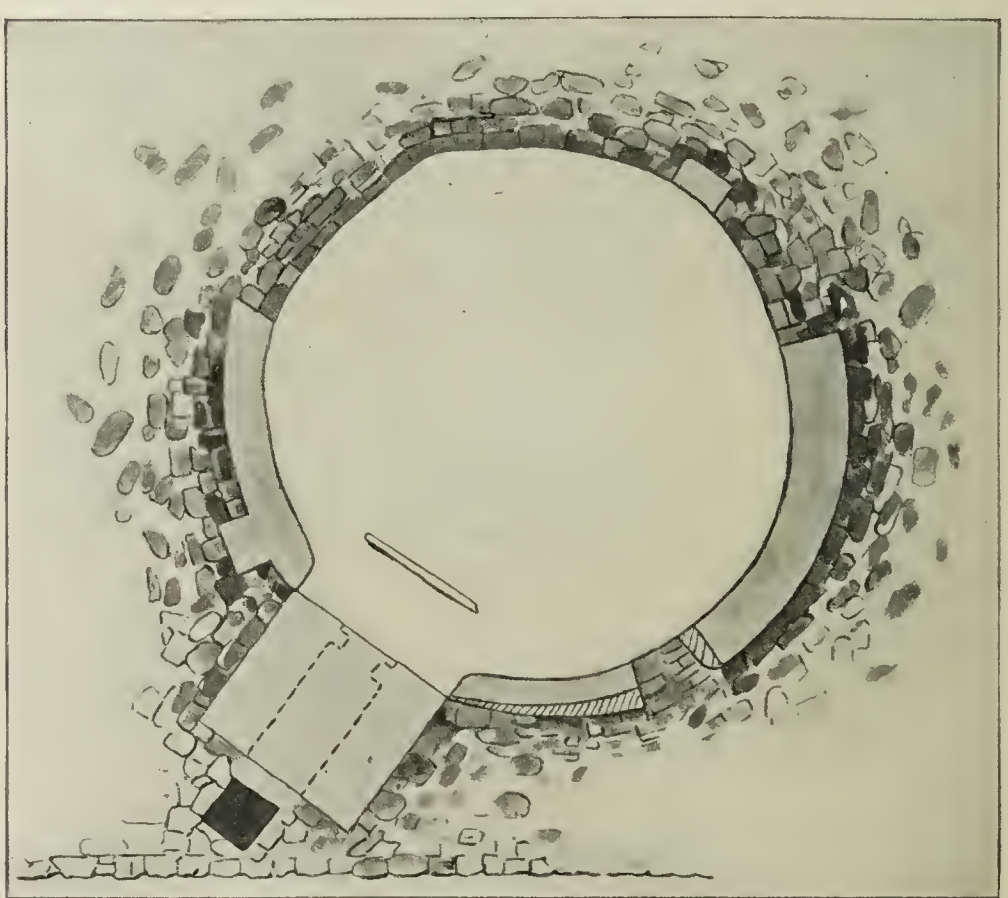


FIG. 82—Plan of the principal kiva in Mummy Cave ruin.

The kiva in Casa Blanca ruin (shown in figure 14) appears to have had an appendage of this sort, not constructed after the usual manner, but added outside the rectangular wall and composed of mud or adobe. At three other places in the lower ruin these structures are found, all constructed of mud or adobe and all attached to adobe walls. It is

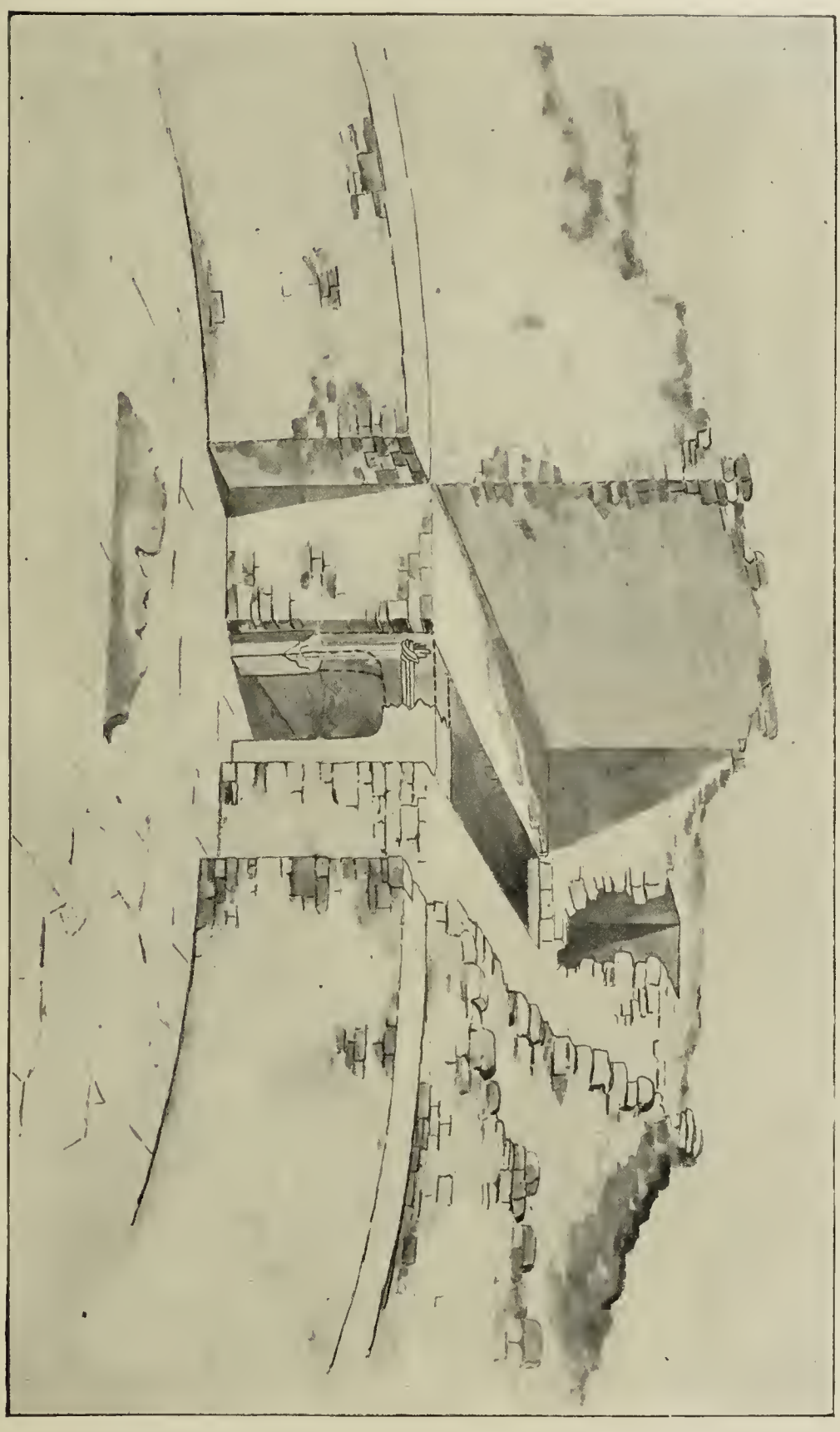


Fig. 83.—Chimney-like structure in Mummy Cave ruin.

doubtful whether these three examples should be classed with the preceding, but as they may have been used in the same manner they should be mentioned here. Another doubtful example occurs in the upper part of the same ruin and has already been described (page 110). It was constructed of stone at some time subsequent to the completion of the wall against which it rests.

Over twenty ago Mr W. H. Holmes found a structure in Mancos canyon which it now appears may be of this type. He illustrates it by a ground plan and thus describes it:

> The most striking feature of this structure [ruin] is the round room, which occurs about the middle of the ruin and inside of a large rectangular apartment. . . . Its walls are not high and not entirely regular, and the inside is curiously fashioned with offsets and box-like projections. It is plastered smoothly and bears considerable evidence of having been used, although I observed no traces of fire. The entrance to this chamber is rather extraordinary, and further attests the peculiar importance attached to it by the builders and their evident desire to secure it from all possibility of intrusion. A walled and covered passageway of solid masonry, 10 feet of which is still intact, leads from an outer chamber through the small intervening apartments into the circular one. It is possible that this originally extended to the outer wall and was entered from the outside. If so, the person desiring to visit the estufa [kiva] would have to enter an aperture about 22 inches high by 30 wide and crawl in the most abject manner possible through a tube-like passageway nearly 20 feet in length. My first impression was that this peculiarly constructed doorway was a precaution against enemies and that it was probably the only means of entrance to the interior of the house, but I am now inclined to think this hardly probable, and conclude that it was rather designed to render a sacred chamber as free as possible from profane intrusion.[1]

In this example the tunnel was much larger than usual and the vertical shaft, if there were one, has been so much broken down that it is no longer distinguishable. Nordenskiöld mentions a considerable number of kivas with this attachment, and one which is described and figured is said to be a type of all the kivas in that region, but an inspection of his ground plans shows more kivas without this feature than with it. In his description of a small ruin in Cliff canyon he speaks of—

> . . . a circular room still in a fair state of preservation. The wall that lies nearest the precipice is for the most part in ruins; the rest of the room is well preserved. After about half a meter of dust and rubbish had been removed, we were able to ascertain that the walls formed a cylinder 4.3 meters in diameter. The thickness of the wall is throughout considerable, and varies, the spaces between the points where the cylinder touches the walls of adjoining rooms[2] having been filled up with masonry. The height of the room is 2 meters. The roof has long since fallen in, and only one or two beams are left among the rubbish. To a height of 1.2 meters from the floor the wall is perfectly even and has the form of a cylinder, or rather of a truncate cone, as it leans slightly inward. The upper portion, on the other hand, is divided by six deep niches into the same number of pillars. The floor is of clay

[1] 10th Ann. Rept. U. S. Geol. and Geog. Survey of the Territories, F. V. Hayden in charge (Washington, 1878); report on the "Ancient ruins of Southwestern Colorado," by W. H. Holmes; p. 395, pl. xxxvii.

[2] In the ground plan given there is no point shown where the walls of the kiva touch adjoining rooms.

hard, and perfectly even. Near the center is a round depression or hole, five-tenths of a meter deep and eight-tenths of a meter in diameter. This hole was entirely full of white ashes. It was undoubtedly the hearth. Between the hearth and the outer wall stands a narrow, curved wall, eight-tenths of a meter high. Behind this wall, in the same plane as the floor, a rectangular opening, 1 meter high and six-tenths of a meter broad, has been constructed in the outer wall. This opening forms the mouth of a narrow passage or tunnel of rectangular shape, which runs 1.8 meters in a horizontal direction and then goes straight upward, out into the open air. The tunnel lies under one of the six niches, which is somewhat deeper than the others. The walls are built of carefully hewn blocks of sandstone, the inner surface being perfectly smooth and lined with a thin, yellowish plaster. On closer examination of this plaster it is found to consist of several thin layers, each of them black with soot. The plaster has evidently been repeatedly restored as the walls became blackened with smoke. A few smaller niches and holes in the walls, irregularly scattered here and there, have presumably served as places of deposit for different articles; a bundle of pieces of hide, tied with a string, was found in one of them. The lower part of the wall, to a height of four-tenths of a meter, is painted dark red around the whole room. This red paint projects upward in triangular points, arranged in threes, and above them is a row of small round dots of red. . . . Circular rooms, built and arranged on exactly the same plan as that described above, reappear with exceedingly slight variations in size and structure in every cliff dwelling except the very smallest ones. . . . The number of estufas [kivas] varies in proportion to the size of the buildings and the number of rooms. . . . [The ruin described contained two kivas.] . . . The description of the first estufa applies in every respect to the second, with the single exception that the whole wall is coated with yellow plaster without any red painting. The wall between the hearth and the singular passage or tunnel described above is replaced by a large slab of stone set on end. It is difficult to say for what purpose this tunnel has been constructed and the slab of stone or the wall erected in front of it. As I have mentioned above, this arrangement is found in all the estufas.[1]

The general similarity between the kivas of De Chelly and those of the Mesa Verde region will be apparent from the above description. It should be added that in the section which accompanies it the roof of the tunnel appears to be supported by a series of small cross sticks, although no information on this point is afforded by the text. The examples which occur in De Chelly are apparently much ruder and more primitive than those of the Mancos, and only one of them approaches the latter in finish and elaboration.

In another place[2] Nordenskiöld mentions an example in which two small sticks were incorporated in the masonry of the upper part of the tunnel in a diagonal position. From this he rejects Holmes' explanation that the passageway was used as an entrance to the kiva, nor does he find the chimney hypothesis satisfactory. He states, further, that the use of this feature as a ventilator seems highly improbable. In one place he found the curtain or screen constructed not of masonry, but—

> . . . of thick stakes, driven into the ground close to each other, and fastened together at the top with osiers. On the side nearest to the hearth this wooden screen was covered with a thick layer of mortar, probably to protect the timber from the heat.[3]

[1] Cliff Dwellers of the Mesa Verde, pp. 15–17 figs. 6 and 7.

[2] Loc. cit., p. 32.

[3] Loc. cit., p. 70.

As stated elsewhere, the first hypothesis formed in the field as to the purpose of these chimney-like structures was that they were abortive chimneys, but this was found untenable. The next hypothesis, formed also in the field, was that they were ceremonial in origin and use, but why they should connect with the open air is not clear. If we could assume that they were ventilators, the problem would be solved, but it is a far cry from pueblo architecture to ventilation; a stride, as it were, over many centuries. Ventilation according to this method—the introduction of fresh air on a low level, striking on a screen a little distance from the inlet and being thereby evenly distributed over the whole chamber—is a development in house architecture reached only by our own civilization within the last few decades.

If the shaft and tunnel were in place, however, the screen might follow as a matter of necessity. Entrance to the kivas is always through the roof, a ceremonial requirement quite as rigidly adhered to today among the Pueblos as it was formerly among their ancestors. The same opening which gives access also provides an exit to the smoke from the fire, which is invariably placed in the center of the kiva below it. This fire is a ceremonial rather than a necessary feature, for in the coldest weather the presence of a dozen men in a small chamber, air-tight except for a small opening in the roof, very soon raises the temperature to an uncomfortable degree, and the air becomes so fetid that a white man, not accustomed to it, is nauseated in half an hour or less. Such are the conditions in the modern kivas of Tusayan. In the smaller structures of De Chelly they must have been worse. The fire is, therefore, made very small and always of very dry wood, so as to diminish as far as possible the output of smoke. Frank H. Cushing states that in certain ceremonials which occur in the kivas it is considered very necessary that the fire should burn brightly and that the flame should rise straight from it. If this requirement prevailed in De Chelly, a screen of some sort would surely follow the construction of a shaft and tunnel.

More or less smoke is generally present in the kivas when a fire is burning, notwithstanding the care taken to prevent it. That a similar condition prevailed in the kivas of De Chelly is shown by the smoke-blackened plaster of the interiors. In some cases there was a room over the kivas which must have increased the difficulty very much. There can be little doubt that the chimney-like structures were not chimneys, and no doubt at all that they did provide an efficient means of ventilation, no matter what the intention of the builders may have been. When we know more of the ceremonials of the Pueblo Indians, and when extensive excavations have developed the various types and varieties of these structures in the ruins, we may be able to determine their object and use.

TRADITIONS

It has often been stated concerning some given ruin or region that the traditions of the present inhabitants of the country do not reach them. In the case of Canyon de Chelly the same statement might be

made, for more than 99 Navaho in 100, when asked what became of the people who built the old houses in De Chelly, will state that a great wind arose and swept them all away, which is equivalent to saying that they do not know. There is a tradition in the Navaho tribe, however, now very difficult to get, as it is confined to a few of the old priests. It recites the occupancy of the canyon before the Navaho obtained possession of it, but, curiously enough, this period is placed after the Spanish invasion. It is even asserted that there were monks in De Chelly, and Mummy Cave, Casa Blanca, and one other ruin have been pointed out as the places where they were stationed. No version of this tradition definite and complete enough for publication could be obtained by the writer, but Dr Washington Matthews, U. S. A., whose knowledge of Navaho myths and traditions is so great that it can almost be termed exhaustive, has obtained one and doubtless will publish it.

The Hopi or Moki Indians, whose villages are some three days' journey to the west, have also very definite traditions bearing on the occupancy of De Chelly.[1] This tribe, like others, is composed of a number of related clans who reached their present location from various directions and at various times; but, with a few exceptions, each of these clans claims to have lived at one time or another in Canyon de Chelly. How much truth there is in these claims can be determined only when the entire region has been examined and thoroughly studied. In the meantime it will probably be safe to assume that some, at least, of the ruins in De Chelly are of Hopi origin.

CONCLUSIONS

To understand the ruins so profusely scattered over the ancient pueblo country we must have some knowledge of the conditions under which their inhabitants lived. Were nothing at all known, however, we would be justified in inferring, from the results that have been produced, a similarity of conditions with those prevailing among the pueblo tribes, both formerly and now; and all the evidence so far obtained would support that inference. There is no warrant whatever for the old assumption that the "cliff dwellers" were a separate race, and the cliff dwellings must be regarded as only a phase of pueblo architecture.

More or less speculation regarding the origin of pueblo culture is the usual and perhaps proper accompaniment of nearly all treatises bearing on that subject. Early writers on the Aztec culture, aided by a vague tradition of that tribe that they came from the north, pushed the point of emigration farther and farther and still farther north, until finally the pueblo country was reached. Pueblo ruins are even now known locally as "Aztec ruins." Logically the inhabited villages should be classed as "Aztec colonies," and such classification was not unusual when the country came into the possession of the United States some fifty years ago.

[1] A résumé of the Hopi traditions was prepared by the writer from material collected by the late A. M. Stephen, and published as chapter iii of "A study of Pueblo architecture," op. cit.

As our knowledge of the pueblo culture increased, a gradual separation between the old and the new took place, and we have as an intermediate hypothesis many "Aztec ruins," but no "Aztec colonies." Finally, as a result of still further knowledge, the ruins and the inhabited pueblos are again brought together; several lines of investigation have combined to show the continuity of the old and the present culture, and the connection may be considered well established. But there is still a disposition to regard the cliff ruins as a thing apart. The old idea of a separate race of cliff dwellers now finds little credence, but the cliff ruins are almost universally explained as the results of extraordinary, primitive, or unusual causes.

The intimate relation between the savage and his physical environment has already been alluded to. Nature, or that part of nature which we term physical environment, enters into and becomes part of the life of the savage in a way and to an extent that we can hardly conceive. A change of physical environment does not produce an immediate change in the man or in his arts, but in time such must inevitably result. Twenty-five years ago the savage of the plains and the savage of the pueblo country were regarded as distinct races, "as different from each other as light is from darkness;" yet the differences which appeared so striking at first have become fewer and fewer as our knowledge of the Indian tribes increased, and those which remain today can almost all be attributed to a difference in physical environment.

Linguistic researches have shown the close connection which exists between the Hopi (Moki) and some of the plains (or so called "wild") Indians. There is no doubt that at the time of the Spanish discovery, some three hundred and fifty years ago, the Hopi were quite as far advanced as the other pueblo tribes, and the conclusion is irresistible that since it may reasonably be inferred that one tribe has made the change from a nomadic to a sedentary life, other tribes also may have done so. We may go even farther than this, and assume that a nomadic tribe driven into the pueblo country, or drifting into it, would remain as before under the direct influence of its physical environment, although the environment would be a new one. Granting this, and the element of time, and we will have no difficulty with the origin of pueblo architecture.

The complete adaptation of pueblo architecture to the country in which it is found has been commented on. Ordinarily such adaptation would imply two things—origin within the country, and a long period of time for development—but there are several factors that must be taken into consideration. If the architecture did not originate in the country where it is found it would almost certainly bear traces of former conditions. Such survivals are common in all arts, and instances of it are so common in architecture that no examples need be cited. Only one of these survivals has been found in pueblo architecture, but that one is very instructive; it is the presence of circular chambers in groups of rectangular rooms, which occur in certain regions. These chambers

are called estufas or kivas and are the council houses and temples of the people, in which the governmental and religious affairs of the tribe are transacted. It is owing to their religious connection that the form has been preserved to the present day, carrying with it the record of the time when the people lived in round chambers or huts.

In opposition to the hypothesis of local origin it might be stated that there is no evidence of forms intermediate in development. The oldest remains of pueblo architecture known are but little different from recent examples. But it must be borne in mind that pueblo architecture is of a very low order, so low that it hardly comes within a definition of architecture as an art, as opposed to a craft. Except for a few examples, some of which have already been mentioned, it was strictly utilitarian in character; the savage had certain needs to supply, and he supplied them in the easiest and most direct manner and with material immediately at hand. The whole pueblo country is covered with the remains of single rooms and groups of rooms, put up to meet some immediate necessity. Some of these may have been built centuries ago, some are only a few years or a few months old, yet the structures do not differ from one another; nor, on the other hand, does the similarity imply that the builder of the oldest example knew less or more than his descendant today—both utilized the material at hand and each accomplished his purpose in the easiest way. In both cases the result is so rude that no sound inference of sequence can be drawn from the study of individual examples, but in the study of large aggregations of rooms we find some clues.

The aggregation of many single rooms into one great structure was produced by causes which have been discussed. It must not be forgotten that the unit of pueblo construction is the single room, even in the large, many-storied villages. This unit is often quite as rude in modern work as in ancient, and both modern and ancient examples are very close to the result which would be produced by any Indian tribe who came into the country and were left free to work out their own ideas. Starting with this unit the whole system of pueblo architecture is a natural product of the country in which it is found and the conditions of life known to have affected the people by whom it was practiced.

Granting the local origin of pueblo architecture it would appear at first sight that a very long period of time must have elapsed between the erection of the first rude rooms and the building of the many-storied pueblos, yet the evidence now available—that derived from the ruins themselves, documentary evidence, and traditions—all suggest that such was not necessarily the case. As a record of events, or rather of a sequence of events, tradition, when unsupported, has practically no value; but as a picture of life and of the conditions under which a people lived it is very instructive and full of suggestions, which, when followed out, often lead to the uncovering of valuable evidence. The traditions of the pueblo tribes record a great number of movements or

migrations from place to place, the statements being more or less obscured by mythologic details and accounts of magic or miraculous occurrences. When numbers of such movements are recorded, it is safe to infer that the conditions dictating the occupancy of sites were unstable or even that the tribes were in a state of slow migration. When this inference is supported by other evidence, it becomes much stronger, and when the supporting evidence becomes more abundant, with no discordant elements, the statement may be accepted as proved until disproved.

The evident inferiority of the modern pueblos to some of the old ruins has been urged as an argument against their connection. While degeneration in culture is yet to be proved, degeneration of some particular art under adverse conditions, such as war, continued famine, or pestilence, is not an uncommon incident in history, and it can be shown that under the peculiar conditions which prevailed in the pueblo country such degeneration would naturally take place. One of the peculiarities of pueblo architecture is that its results were obtained always by the employment of the material immediately at hand. In the whole pueblo region no instance is known where the material (other than timber) was transported to any distance; on the contrary, it was usually obtained within a few feet of the site where it was used. Hence, it comes about that difference in character of masonry is often only a difference in material. Starting with a tribe or several tribes of plains Indians, who came into the pueblo country, we should probably see them at first building houses such as they were accustomed to build—round huts of skin or brush, perhaps partly covered with earth, such as were found all over middle and eastern United States. Supposing the tribe to have been not very warlike in character and subsisting principally by horticulture, these settlements would necessarily be confined to the vicinity of springs and to little valleys where the crops could be grown. The general character of the country is arid in the extreme, and only in favored spots is horticulture possible. In a very short time these people would be forced to the use of stone for buildings, for the whole country is covered with tabular sandstone, often broken up into blocks and flakes ready for immediate use without any preparation whatever. Timber and brush could be procured only with difficulty, and often had to be carried great distances.

It has been suggested that the rectangular form of rooms might have been developed from the circular form by the crowding together upon restricted sites of many circular chambers; but such a supposition seems unnecessary. A structure of masonry designed to be roofed would naturally be rectangular; in fact, the placing of a flat roof upon a circular chamber was a problem whose solution was beyond the ability of these people, as has already been shown. Along with this advance, or perhaps preceding it, the social organization of the tribe, or its division into clans and phratries, would manifest itself, and those who "belong together" would build together. This requirement was a very common one and was closely adhered to even a few years ago.

Although degeneration in arts is common enough, a peculiar condition prevailed in the pueblo region. So far as the architecture was concerned war and a hostile human environment produced not degeneration but development. This came about partly by reason of the peculiarities of the country, and partly through the methods of war. The term war is rather a misnomer in this connection, as it does not express the idea. The result was not brought about by armed bodies of men animated by hostile intentions or bent on extermination, although forays of this kind are too common in later pueblo history, but rather by predatory bands, bent on robbery and not indisposed to incidental killing. The pueblos, with their fixed habitations and their stores of food, were the natural prey of such bands, and they suffered, just as did, at a later period, the Mexican settlements on the Rio Grande, with their immense flocks of sheep. It was constant annoyance and danger, rather than war and pitched battles.

The pueblo country is exceptionally rich in building material suited to the knowledge and capacity of the pueblo builders. Had suitable material been less abundant, military knowledge would have developed and defensive structures would have been erected; but as such material could be obtained everywhere, and there was no lack of sites, almost if not quite equal to those occupied at any given time, the easiest and most natural thing to do was to move. Owing to the nature of the hostile pressure, such movements were generally gradual, not en masse; although there is no doubt that movements of the latter kind have sometimes taken place.

These conclusions are not based on a study of the ruins in Canyon de Chelly alone, which illustrate only one phase of the subject, but of all the pueblo remains, or rather of the remains so far as they are now known. They imply a rather sparsely settled country, occupied by a comparatively small number of tribes and subtribes, moving from place to place under the influence of various motives, some of which we know, others we can only surmise. It was a slow but practically constant migratory movement with no definite end or direction in view. The course of this movement in a geographical way does not as yet reveal a preponderance in any one direction; tribes and subtribes moved from east to west and from west to east, from north to south and from south to north, and many were irregular in their course, but the movements, so far as they can now be discerned, were all within a circumscribed area.

There is no evidence of any movement from without into the pueblo group, unless the close relation of the Hopi (Moki) language to the other Shoshonean dialects be such evidence, and none of a movement from within this area out of it, although such movements must have taken place, at least in the early history of the region. It must be borne in mind in this discussion that while we can assign approximate boundaries to the ancient pueblo region on the north, east, and west, no limit can as yet be fixed on the south. The arid country southward of Gila river and northward of the Mexican boundary would be a great

obstacle to a movement either north or south, but little as we know about that region we do know that it was not an insurmountable obstacle. The Casas Grandes of Janos, in Chihuahua, closely resemble the type of ruins on the Gila river, in Arizona, of which the best example we now have is the well-known Casa Grande ruin. We know that there are cliff ruins in the Sierra Madre, but beyond this we know little. Concerning the immense region which stretches from Gila river to the valley of Mexico, over 1300 miles in length, we know practically nothing.

In that portion of the pueblo region lying within the United States migratory movements have, as a rule, been confined to very small areas, each linguistic family moving within its own circumscribed region. Some instances of movement away from the home region have taken place even in historic times, as, for example, the migration of a considerable band of Tewas from the Rio Grande to Tusayan, where they now are, and moreover, this movement probably occurred en masse and over a considerable distance; but there is little doubt that the usual procedure was different.

Canyon de Chelly was occupied because it was the best place in that vicinity for the practice of horticulture. The cliff ruins there grew out of the natural conditions, as they have in other places. It is not meant that a type of house structure developed here and was transferred subsequently to other places. When the geological and topographical environment favored their construction, cliff outlooks were built; from a different geological structure in certain regions cavate lodges resulted; in other places there were "watch towers;" in still others single rooms were built, either alone or in clusters, and these results obtained quite as often if not oftener within the historic period as in prehistoric times.

Notwithstanding the possible division of the De Chelly ruins into four well defined types, there is no warrant for the assumption of a large population. The types are interrelated and to a large extent were inhabited not contemporaneously but conjointly. There are about 140 ruins in Canyon de Chelly and its branches, but few of them could accommodate more than a very small population. Settlements large enough to furnish homes for 50 or 60 people were rare. As not all of the sites were occupied at one time, the maximum population of the canyon could hardly have exceeded 400; it is more likely to have been 300.

The character of the site occupied is one of the most important elements to be studied in the examination of ruins in the pueblo country. In De Chelly whatever defensive value the settlements had was due to the character of the sites selected. It is believed, however, that other considerations dictated the selection of the sites, and that the defensive motive, if present at all, exercised very little influence in this region. The sites here are always selected with a view to an outlook over some adjacent area of cultivable land, and the structures erected on them were industrial or horticultural, rather than military or defensive.

The masonry of the ruins and the constructive expedients employed by the builders are an insurmountable obstacle in the way of the hypothesis that the cliff ruins represent a primitive or intermediate stage in the growth of pueblo architecture. The builders were well acquainted with the principles and methods of construction employed in the best work found in other regions; the inferiority of their work is due to special conditions and to the locality. The presence of a number of extraneous features, both in methods and principles employed, is further evidence in the same line. These features are certainly foreign to this region, some of them suggest even Spanish or Mexican origin, which implies comparatively recent occupancy.

The openings—doorways and windows—found in the ruins are of the regular pueblo types. They are arranged as convenience dictated, without any reference to the defensive motive, which, if it existed at all, exercised less influence here than it did in the modern pueblos. There is no evidence of the use of very modern features, such as the paneled wooden doors found in the pueblos; nor, on the other hand, are there any very primitive expedients or methods—none which can not be found today in the modern villages.

The roof, floors, and timber work are also essentially the same as the examples found in the modern pueblos. The notable scarcity of roofing timbers in the ruins can probably be explained by the hypothesis of successive occupancies and subsequent or repeated use of material difficult to obtain. So far as regards the use of timber as an element of masonry construction the results obtained in De Chelly are rude and primitive as compared with the work found in other regions.

The immense number of storage cists found in De Chelly are a natural outgrowth of the conditions there and support the hypothesis that the cliff outlooks were merely farming shelters. The small size of many of the settlements made the construction of storage cists a necessity. The storage of water was very seldom attempted. A large proportion of the cists found in De Chelly were burial places and of Navaho origin. As a rule they are far more difficult of access than the ruins.

There is no evidence of the influence of the defensive motive. Defensive works on the approaches to sites are never found, nor can such influence be detected in the arrangement of openings, in the character of masonry, or in the ground plan. If the cliff ruins were defensive structures, an influence strong enough to bring about the occupancy of such inconvenient and unsuitable sites would certainly be strong enough also to bring about some slight modifications in the architecture, such as would render more suitable sites available. If we assume that the cliff ruins were farming outlooks, occupied only during the farming season, and then only for a few days or weeks at a time, the character of the sites occupied by them seems natural enough, for the same sites are used by the Navaho today in connection with farming operations.

The distribution of kivas in the ruins of De Chelly affords another indication that the occupancy of that region was quiet and little disturbed,

and that the ruins were in no sense defensive structures. Kivas are found only in permanent settlements, and the presence of two or three of them in a small settlement comprising a total of five or six rooms implies, first, that the little village was the home of two or more families, and, second, that there was comparative if not entire immunity from hostile incursions. If the conditions were otherwise, these small settlements would have combined into larger ones, as was done in other regions. Probably these small settlements with several kivas mark a late period in the use of outlying sites. The position of the kivas in some of the settlements on defensive sites, and their arrangement across the front of the cove, suggest that such sites were first used for outlooks, and that their occupancy by regular villages came at a later period.

All of the now available traditions of the Navaho and of the Hopi Indians support the conclusions reached from a study of the intrinsic evidence of the ruins, that they represent a comparatively late period in the history of pueblo architecture. It appears that some at least of the ruins are of Hopi origin. It is certain that the ruins were not occupied at one time, nor by one tribe or band.

As criteria in development or in time the cliff ruins are valueless, except in a certain restricted way. They represent simply a phase of pueblo life, due more to the geological character of the region occupied than to extraordinary conditions, and they pertain partly to the old villages, partly to the more modern. Apparently they reached their greatest (not their highest) development in the period immediately preceding the last well-defined stage in the growth of pueblo architecture, a stage in which most of the pueblos were at the time of their discovery by the Spaniards, and in which some of them are now. Reliance for defense was had on the site occupied, and outlying settlements for horticultural purposes were very numerous, as they must necessarily be also in the last stage—the aggregation of many related villages into one great cluster.

The cliff outlooks in Canyon de Chelly and in other regions, the cavate lodges of New Mexico and Arizona, the "watch towers" of the San Juan and of the Zuñi country, the summer villages attached to many of the pueblos, the single-room remains found everywhere, even the brush shelters or "kisis" of Tusayan, are all functionally analogous, and all are the outgrowth of certain industrial requirements, which were essentially the same throughout the pueblo country, but whose product was modified by geological and topographical conditions. In the cliff ruins of De Chelly we have an interesting and most instructive example of the influence of a peculiar and sometimes adverse environment on a primitive people, who entered the region with preconceived and, as it were, fully developed ideas of house construction, and who left it before those ideas were brought fully in accord with the environment, but not before they were influenced by it.

DAY SYMBOLS OF THE MAYA YEAR

BY

CYRUS THOMAS

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DAY SYMBOLS OF THE MAYA YEAR

By Cyrus Thomas

INTRODUCTORY

As the origin and signification of the day and month names of the Maya calendar, and of the symbols used to represent these time periods, are now being discussed by students of Mexican and Central American paleography, I deem it advisable to present the result of my investigations in this line. The present paper, however, will be limited to the days only, as I have but little to add in regard to the month names or symbols. As the conclusion reached by Drs Seler and Brinton in regard to the order and sequence of the days of the month in the different calendars appears to be satisfactorily established, it will be accepted.

As frequent allusion is made herein to the phoneticism or phonetic value of the written characters or hieroglyphs, it is proper that the writer's position on this point should be clearly understood. He does not claim that the Maya scribes had reached that advanced stage where they could indicate each letter-sound by a glyph or symbol. On the contrary, he thinks a symbol, probably derived in most cases from an older method of picture writing, was selected because the name or word it represented had as its chief phonetic element a certain consonant sound or syllable. If this consonant element were *b*, the symbol would be used where *b* was the prominent consonant element of the word to be indicated, no reference, however, to its original signification being necessarily retained. Thus the symbol for *cab*, "earth," might be used in writing *Caban*, a day name, or *cabil*, "honey," because *cab* is their chief phonetic element.

In a previous work[1] I have expressed the opinion that the characters are to a certain extent phonetic—are not true alphabetic signs, but syllabic. And at the same time I expressed the opinion that even this definition did not hold true of all, as some were apparently ideographic, while others were simple abbreviated pictorial representations. In a subsequent paper[2] I expressed substantially the same opinion, and gave as my belief that one reason why attempts at decipherment have failed of success is a misconception of the peculiar character of the writing, which peculiarity is found in the fact that, as it exists in the codices and inscriptions, it is in a transition stage from the purely ideographic to the phonetic. I stated also my belief that the writing had not reached the stage when each sound was indicated by a glyph or sign.

[1] Study of the Manuscript Troano, pref., p. viii.
[2] American Anthropologist, Washington, July, 1893.

This may further be explained by the following illustration: The conventionalized figure of a turtlehead is the symbol for a "turtle," *ak*, *ac*, or *aac* in Maya: and a conventionalized footprint is the symbol for "step" or "road," *be*, *beil*, in Maya. These may be brought together to form the word *akyab* or *kayab*, which may have no reference to the original signification of the combined symbols. These two glyphs are, in fact, combined to form the symbol for the month *Kayab*.

These statements will perhaps suffice to make clear my views on this question, which do not appear to have been clearly understood, possibly because of my frequent use of the words "phonetic" and "phoneticism," and perhaps rather loose reference to "letter elements."

It is proper, however, to add that I am inclined to the opinion that modification in the form and details of a glyph which belongs to the class which, for want of a better term, we may designate "phonetic," in many cases indicates a modification or change in the signification or word value. I say in "many cases," because these modifications are due often to the greater or lesser accuracy with which the glyph is drawn, the caprice of the scribe, and other causes which have no reference to sound or signification. For example, the change of a rounded or circular symbol to a face figure, as is often done, does not appear, at least in the day signs, to have any significance. On the other hand, a slight variation, if permanent, may be indicative of a difference in signification or phonetic value. This appears to be true, to some extent, whether we consider the characters ideographic or as, in some sense, phonetic.

The lists of the days in the Maya, Tzental, Quiche-Cakchiquel, Zapotec, and Nahuatl, in the order usually given, are as follows:

Names of the days in the different calendars

Maya	Tzental	Quiche-Cakchiquel	Zapotec	Nahuatl
Imix.	Imox.	Imox.	Chilla.	Cipactli.
Ik.	Igh.	Ik'.	Gui, Ni, Laa.	Ehecatl.
Akbal.	Votan.	Akbal.	Guèla.	Calli.
Kan.	Ghanan.	K'at.	Guache.	Cuetzpallin.
Chicchan.	Abagh.	Can.	Ci, Ziie.	Cohuatl.
Cimi.	Tox.	Camey.	Lana.	Miquiztli.
Manik.	Moxic.	Queh.	China.	Mazatl.
Lamat.	Lambat.	Canel.	Lapa.	Tochtli.
Muluc.	Molo.	Toh.	Niza.	Atl.
Oc.	Elab.	Tzi.	Tella.	Itzcuintli.
Chuen.	Batz.	Batz.	Goloo.	Ozomatli.
Eb.	Euob.	E, Ee.	Pija.	Mallinalli.
Ben, Been.	Ben.	Ah.	Quii.	Acatl.
Ix, Hix.	Hix.	Balam.	Eche.	Ocelotl.
Men.	Tziquin.	Tziquin.	Naa.	Quauhtli.

Maya	Tzental	Quiche-Cakchiquel	Zapotec	Nahuatl
Cib.	Chabin.	Ahmak.	Loo.	Cozcaquauhtli.
Caban.	Chic.	Noh.	Xoo.	Ollin.
Edznab.	Chinax.	Tihax.	Gopaa.	Tecpatl.
Cauac.	Cahogh.	Caoc.	Appe.	Quiahuitl.
Ahau.	Aghual.	Hunahpu.	Lao.	Xochitl.

THE FIRST DAY

Maya, *imix* (or *ymix*); Tzental, *imox* or *mox*; Quiche-Cakchiquel, *imox* or *moxin*; Zapotec, *chilla* or *chiylla*; Nahuatl, *cipactli*.

The symbol of this day, which is quite uniform in the day series of the codices, is shown in plate LXIV, 1.[1] In this the essential features appear to be the black spot at the top, the semicircle of dots around it, and the short perpendicular lines in the lower half. The form on the right slab of the "Palenque tablet," and also in the Lorillard City inscription, copied by Charney, is given in plate LXIV, 2. The only particular in which this differs from the other is that the little circle at the top is crosshatched. The form shown in LXIV, 3, is found in the Tikal inscription; it shows also the crosshatching in the little circle at the top. This character, however, when combined with other glyphs, and when used otherwise than as a day symbol, sometimes varies from the types given. For example, in the symbol of the month *Mac* it is as shown in plate LXIV, 4. In this a minute, divided oblong, takes the place of the dark spot at the top, and a double curved line accompanies the circle of dots. Another form is shown in plate LXIV, 5. The only variation in this from the usual type is the introduction of two or three minute circles in the curved line of dots and the divided oblong. Dr Seler is inclined to believe that these are essential variants from the true *imix* symbol; nevertheless, as *m* is the chief consonant element both in *imix*, or *mox* and *mac*, there appears to be a relation between the form of the glyphs and their phonetic value.

Drs Seler and Schellhas believe *im* to be the radical of *imix* and *imox*, which are dialectal variations of the same word. Dr Brinton, however, basing his opinion on the fact that *mox* and *moxin* are used sometimes as equivalents, decides that the radical syllable is *m-x*. In this he is probably correct, and if so, this furnishes additional evidence of the close relation between form and sound, as in one case *m-x* are the chief phonetic elements and in the other *m-c*. It is probable that Drs Schellhas and Seler were led to their conclusion by the fact that the symbol bears a close resemblance to the conventional form of the female breast, which in Maya is *im*. This, which was perhaps the origin of the symbol, was probably selected simply because *m* is its only prominent ele-

[1]The plates are designated by Roman numerals, and the figures by the Arabic numbers 1, 2, 3, etc. Hence LXIV, 1, signifies figure 1 of plate LXIV; LXIV, 2, figure 2 of plate LXIV, etc.

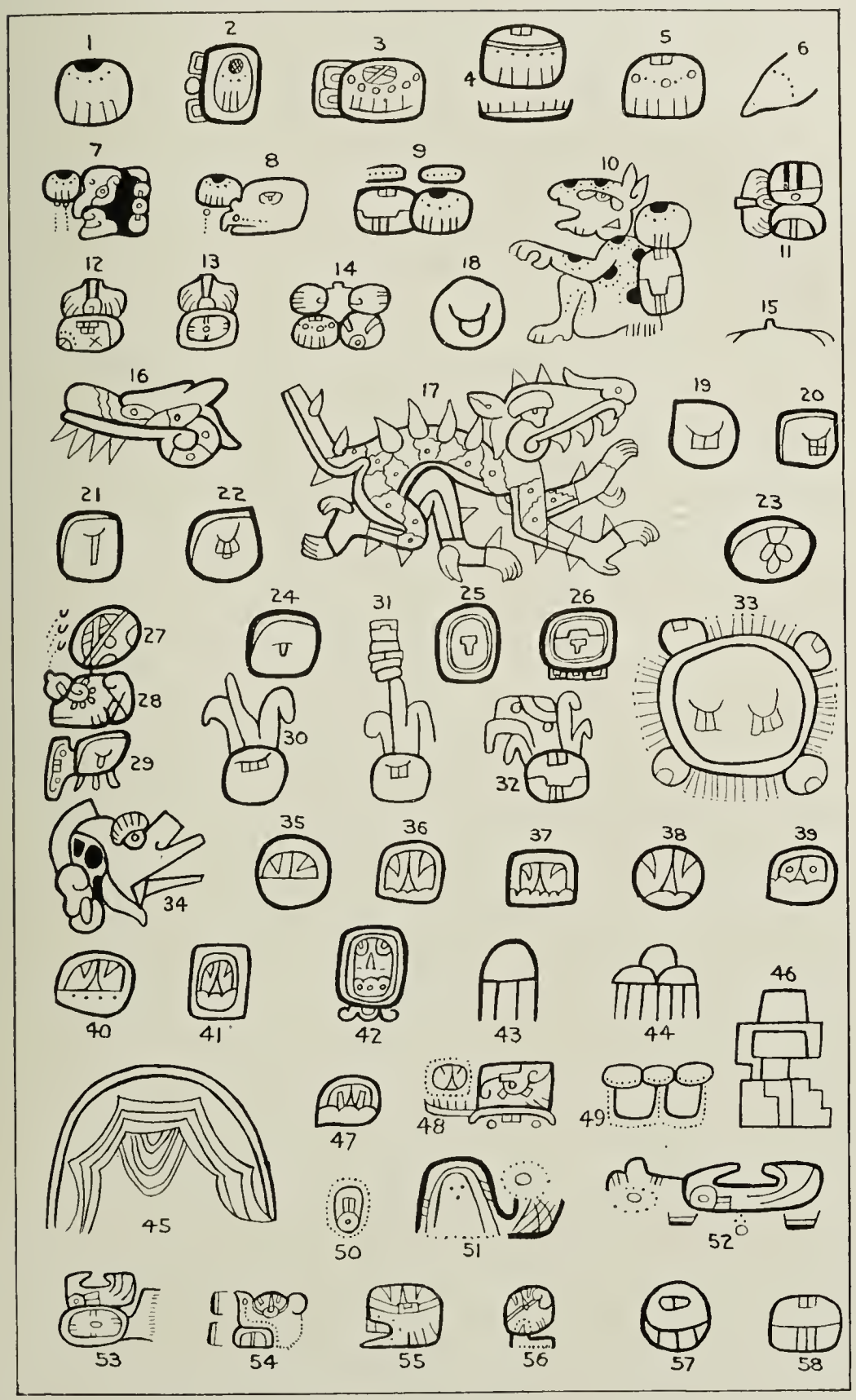
ment. Nevertheless, it is worthy of notice that the symbol for the day *Ix* is frequently represented as shown in plate LXVI, 36, from Tro. 5*e. This is similar in some respects to the *Imix* symbol, and the name contains the *i* and *x* of the latter. If the writing is phonetic, the points of resemblance may have some significance, otherwise they do not.

In a previous paper[1] I suggested that the probable signification of the character LXIV, 7, from Dres. 14c and 46b, is *maax*, "monkey, ape, imitator." Below the text in each case is seen a dark male figure (or deity), to which it undoubtedly refers, as is conceded by Drs Schellhas and Seler. The face character, which forms part of the glyph, may be only a determinative; at least I am unable to assign it any other value in this connection, and the necessity for such determinative is apparent. Brasseur, under *akab-maax*, speaks of a phantom or hobgoblin of this name, which he says signifies "the great monkey of the night." Perez gives as definitions "duende" (elf or hobgoblin) and "mico nocturno." Henderson, who writes the name *akabmax*, simply says "sprite, phantom." It would seem, therefore, that among the superstitious beliefs of the Maya was that of a night phantom or deity, which took the form of a monkey. But this black figure appears to be different from those on Tro. 34*–31*, with which Seler connects it and to which he applies the name Ekchuah.[2]

In the paper above referred to, I have interpreted the symbol shown in plate LXIV, 8 (from Dres. 35c) *maach*, "the crow," assuming the bird-head to be a determinative. Seler concludes that the bird which this represents is "a substitute, colleague, or symbol of the Rain god Chac," the so-called Maya Tlaloc so frequently represented in the codices. Although there is in this case no bird figure below to confirm our interpretation, yet it appears to be justified by the comparisons given and by its agreement with the phonetic value of the *imix* symbol. It is also further confirmed by the two glyphs shown in plate LXVIII, 13, 14, which occur together in Dres. 38b. In this case the two characters, which are combined in plate LXIV, 8, are separated, yet must have the same signification. Here the bird figure (a man with a bird's head or bird mask) is seen below. In both instances rain is represented, showing that the bird is supposed to bear some relation thereto. But it is more likely that it has direct reference to the wind which accompanies the rain storm rather than to "fruitfulness," as Seler supposes. Be this, however, as it may, our rendering of the *imix* symbol in this

[1] American Anthropologist, July, 1893, p. 254.

[2] There appears to be much confusion among writers who have referred to this subject in regard to the "Black Deities" of the codices. Dr Brinton's remarks on this subject in his late work, "A Primer of Mayan Hieroglyphics," does not clear up the confusion. Apparently he has not discovered that quite a number of these are merely black figures of well-recognized deities not thus usually colored. It appears also, judging by his statements, that Dr. Brinton has failed to identify the characteristics by which the different deities of this class are to be distinguished. Dr Schellhas, in his excellent paper "Die Gottergestalten der Maya Handschriften," fails also to properly distinguish between these deities. Dr Seler, whose profound studies have thrown much light on the Maya hieroglyphs, fixes quite satisfactorily the characteristics of some of these deities, yet he confounds others which should have been separated.



COPIES OF GLYPHS FROM THE CODICES

connection appears to be justified, and indicates that the symbol is used here for its phonetic value rather than with any reference to its primary signification.

Dr Seler also refers in this connection to the lower line of symbols on Dres. 29-30b (three of which are shown in plate LXVIII, 15, 16, 17); to those shown in plate LXVIII, 18, 19, from Tro. 14e; and those shown in plate LXVIII, 20, 21, from Tro. 11a. He remarks that "in a number of hieroglyphs the character *imix* stands as an equivalent of a peculiar animal head which bears as a distinctive mark the element *akbal* over the eye. Thus in the hieroglyphs enumerating those above mentioned which, standing after the hieroglyphs of the cardinal points, seem to express the deities presiding over them, indeed there appears here on the same animal head, on one hand the character *imix*, on the other the element figure 165" (our plate LXIV, 5).

Although I am unable to interpret satisfactorily the *imix* symbols in the places above referred to, I think it can be made apparent that Dr Seler's explanation is without foundation. For instance, by referring to the plates of the Dresden and Troano codices mentioned, it will be seen that there is nothing whatever that refers to an "animal head which bears the element *akbal* over the eye," unless we suppose it to be in plate LXVIII, 16 (from Dres. 29b) and LXVIII, 21 (from Tro. 11a). There is no figure below or connected with either series to justify this conclusion. It is also certain that plate LXVIII, 21 (Tro. 11a) is not an animal head. Possibly plate LXVIII, 16 (Dres. 29b) may be intended for an animal head, but this is not certain and, moreover, it is not repeated in the series.

Referring to Cort. 27a it will be seen that the compound glyph shown in plate LXVIII, 22 (apparently the same as that on Tro. 11a) is repeated four times in one line, each connected with a cardinal point symbol, and each standing immediately over and evidently referring to a large vessel.[1] It is stated that it was a custom among the Maya during certain religious ceremonies to place a vessel in their temples at each of the four cardinal points.[2] As *cum* and *xamach* are Maya words signifying vessel, we still find in these the *m* sound. It is therefore possible that the similar glyphs on Dres. 29b and Tro. 14 and 15 also refer to vessels. The supposition seems to be strengthened by the fact that connected

[1] Dr Brinton (Primer of Mayan Hieroglyphics, p. 93) claims to have discovered that this hitherto supposed "vessel" is, in reality, "a drum." As the four (Cort. 27a) are without any accompaniments to indicate their use as drums, and as each has above it one of the cardinal point signs, there is nothing, unless it be the form, to lead to the supposition that they are drums. In the same division of the two preceding and three following pages we see vessels of different kinds represented. In the lower divisions pages 29 and 30, are vessels somewhat of the same elongate, cylindrical form, borne on the backs of individuals; and also in the lower division of page 40 are four tall cylindrical vessels, in each of which the arm of a deity figure is thrust. This section is copied in Dr Brinton's work with the subscript "The beneficent gods draw from their stores." Additional proof, if any is needed to show that these are vessels, is found in the Tro. Codex. On plates 6* and 7* are tall cylindrical vessels with the same inverted V marks on them; moreover, one of them has the upper portion margined by the same tooth-like projection as those in the Cortesian plate. That these are vessels of some kind is apparent from the use the pictures show is made of them.

[2] See Brasseur's Lexicon under *bacab*, also the mention below, under the day *Ik*, of four vessels.

with the former are figures of the four classes of food animals—quadrupeds, birds, reptiles (iguana), and fishes. The latter refer to the hunter's occupation, being accompanied by figures of the deer. Landa, in his descriptions of the various festivals, repeatedly alludes to the four Chacs or Bacabs which represent the four cardinal points, and to the different classes of food animals presented where vessels were used. It is therefore more likely that the symbol is used in the places mentioned because of its phonetic value rather than as a substitute for the heads of lightning animals, for which supposed substitution Dr Seler admits he can not account.

Dr Seler refers also to the glyph on which the long nose deity is seated, Dres. 44a, shown in our plate LXVIII, 23. The prefix he interprets by "man, human being," and supposes the whole glyph refers to the attributes of the Rain god. As the deity holds a fish in his hand, and is seen in the lowest division of the same plate in the act of seining fish, is it not more likely that this symbol should be rendered by *cayom*, "a fisherman"? This is appropriate and retains the phonetic value of the *imix* symbol.

In the compound glyph 24, plate LXVIII, from Dres. 67b, to which Seler also refers in the same connection, we see in the figure below the same deity wading in water in which a fish is swimming. The right portion of the symbol is the same as the last (plate LXVIII, 23) and presumably has the same signification—*cayom*, "a fisherman," or *cayomal*, "to fish." I am unable to interpret the first or left-hand character; possibly it may be found in one of the terms *chucay*, or *zaucay*, which Henderson gives as equivalents of *cayomal*. The latter—*zaucay*—would give to this prefix precisely the phonetic value I have hitherto assigned it.

The next character Dr Seler refers to in this connection is that shown in plate LXVIII, 25, from Dres. 40c, where the long-nose god is seen below rowing a boat on the water. The adjoining symbol in the text is a fish. It is probable therefore that substantially the same interpretation is to be given here.

The group shown in plate LXIV, 9, consisting of an *Imix* and *Kan* symbol, is of frequent occurrence in all the codices. The relation of the characters in this combination varies, the order being frequently the reverse of that given in the figure, and again one being placed on top of the other. They frequently follow deity symbols, especially the symbol of the so-called "Corn god," and in these instances seem to refer to some attribute of the divinity indicated. However, they are by no means confined to these relations, being found quite frequently in other connections. The combination is occasionally borne upon the back of an individual, as Dres. 16a, and on Tro. 21b it is on the back of a dog. Dr Seler concludes "that it denotes the copal or the offering of incense." However, he subsequently[1] expresses the view that it may signify "beans and maize." In a previous work[2] some reasons were presented by me for

[1] Zeitschrift für Ethnologie, p. 115.

[2] A Study of the Manuscript Troano, pp. 80 and 56.

believing this combination was intended to denote bread or maize bread. This belief is based on the statement by Landa in his account of the sacrifices at the beginning of the year *Muluc*, that they made "images of dogs, in baked earth, carrying bread on the back," and the fact that in plate 21 of the Codex Tro., representing the sacrifices of this year, we see the figure of a dog with this *Kan-Imix* group on its back. This figure (plate LXIV, 10) probably represents the images of which Landa speaks, and the symbols on the back, bread or food in the general sense. Further notice of this combination will be given under the fourth day, *Kan*.

The character shown in plate LXVIII, 26, from Tro. 20*d, is erroneously given by Seler as an example of the *kan-imix* symbol. The two glyphs on the mat figure are unquestionably *imix* symbols, though of the two different types shown in plate LXIV, 1 and 5. He suggests that here it replaces the deity symbol, but this is contradicted by the fact that in both groups where it appears the deity symbol is present. The mat-like figure, which is probably a determinative, shows that it refers to the sack, bag, or kind of hamper which the women figured below bear on the back, filled with corn, bones, etc. As *mucuc* signifies "portmanteau, bag, sack, etc," *mucub* "a bag or sack made of sackcloth," and *mucubcuch* "to carry anything in a sack or folded in a shawl," it is more than probable we have in these words the signification of the symbol. The duplication of the *imix* symbol may be to denote the plural; or, as the words come from a root signifying "secret, hidden, covered," it may be to intensify. It is noticeable also that the latter or right-hand *Imix* symbol is similar to that used for the month *Mac*.

In the right section of Dres. 41b is the glyph shown in plate LXIV, 11, which, according to the phonetic system that appears to prevail in this writing, may be translated *yulpolic*, from *yulpol*, "to smooth or plane wood," or, as given by Henderson (MS. Lexicon), "to smooth, plane, or square timber, to beat off the log." This interpretation, which is given here merely because of its relation to the symbol which follows, is based in part on the following evidence: The left character, which has *y* as its chief phonetic element, is the same as the upper character in the symbol for the month *Yax* (plate LXIV, 12), and also the upper character of the symbol for the month *Yaxkin* (plate LXIV, 13). Other evidence of its use with this value will be presented farther on, and also in reference to the right character of the above-mentioned symbol (plate LXIV, 11), which has been given *p* as its chief phonetic element. By reference to the figure below the text the appropriateness of this rendering is at once apparent, as here is represented an individual in the act of chipping off the side of a tree. This he appears to be doing by holding in his left hand an instrument resembling a frow, which he strikes with a hatchet.

The character immediately below the one above mentioned and belonging to the same series is shown in plate LXIV, 14. It may be interpreted *mamachah*, "to make flat by repeated strokes." The phonetic

value of the parts is obtained in this way. The upper character with two wings is Landa's *ma*, except that the circular wings contain the lines or strokes which the bishop has omitted, and which appear to indicate the *m* sound and are observed in the *Imix* symbol. Colonel Mallery, comparing this with the sign of negation made by the Indians and that of the Egyptians given by Champollion (our plate LXIV, 15), concludes that it is derived from the symmetrically extended arms with the hands curved slightly downward. This will furnish an explanation of the strokes in the terminal circles. The left of the two lower characters is almost identical with the symbol for the month *Mac* (plate LXIV, 4), omitting the *ca* glyph. The lower right-hand character is similar to the symbol for the month *Chuen*. We thus obtain legitimately the sounds *ma ma-ch*, whether we consider the parts truly phonetic or only ikonomatic.

For further illustration of the use of this symbol and evidence of phoneticism, the reader is referred to the article in the *American Anthropologist* above mentioned.

The fact that a symbol is used to denote a given Maya day does not prove, supposing it to be in any sense phonetic, that the Maya name gives the original equivalent. It may have been adopted to represent the older name in the Tzental, or borrowed from the Zapotec calendar and retained in the Maya calendar for the new name given in that tongue. However, the symbol for this first day, which has substantially the same name in the Maya and Tzental, appears to represent the name in these languages and to be in some degree phonetic, *m* being the chief phonetic element represented by it. The crosshatching in the little circle at the top, seen in some of the older forms found in the inscriptions, may indicate, as will later be seen, the *x* or *ch* sound, thus giving precisely the radical *m-x*.

It may be said, in reference to the signification of the names of the day in different dialects, that no settled or entirely satisfactory conclusion has been reached in regard to either.

The Cakchiquel word *imox* is translated by the grammarian Ximenes as "swordfish," thus corresponding with the usual interpretation of the Mexican *cipactli*. Dr Seler thinks, however, that the Maya names were derived, as above stated, from *im*. Nevertheless he concludes that the primitive signification of both the Maya and Mexican symbols is the earth, "who brings forth all things from her bosom and takes all living things again into it." If we may judge from its use, there is no doubt that the Mexican *cipactli* figure is a symbol of the earth or underworld. The usual form of the day symbol in the Mexican codices is shown in plate LXIV, 16, and more elaborately in plate LXIV, 17. As proof that it indicates the earth or underworld, there is shown on plate 73 of the Borgian Codex an individual, whose heart has been torn from his breast, plunging downward through the open jaws of the monster into the shades or earth below. On plate 76 of the same codex, the

extended jaws open upward, and into them a number of persons are marching in regular order. These apparently represent the thirteen months of the sacred year. One has passed on and disappeared from view, and the other twelve are following with bowed heads. It would seem from these to be not only symbolic of the earth or hades, but also to have some relation to time.

For positive proof that it is sometimes used to denote the earth, or that from which vegetation comes, it is only necessary to refer to the lower right-hand figure of plate 12, Borgian Codex. Here is Tlaloc sending down rain upon the earth, from which the enlivened plants are springing forth and expanding into leaf and blossom. The earth, on which they stand and from which they arise, is represented by the figure of the mythical *Cipactli*.

It is quite probable that the monster on plates 4 and 5 of the Dresden Codex, which appears to be of the same genus, is a time symbol, and also that on plate 74 of the same codex. It is therefore more than likely that the animal indicated by the Mexican name of the day is mythical, represented according to locality by some known animal which seems to indicate best the mythical conception. Some figures evidently refer to the alligator, and others apparently to the iguana; that on plates 4 and 5 of the Dresden Codex is purely mythical, but contains reptilian characteristics.

Dr Brinton, probably influenced to some extent by the apparent signification of the Nahuatl name and symbol, explains the other names as follows:

> This leads me to identify it [the Maya name] with the Maya *mex* or *meex*, which is the name of a fish (the "pez arana," "un pescado que tiene muchos brazos"), probably so called from another meaning of *mex*, "the beard." . . . This identification brings this day name into direct relation to the Zapotec and Nahuatl names. In the former, *chiylla*, sometimes given as *pi-chilla*, is apparently from *bi-chilla-beo*, water lizard, and Nahuatl *cipactli* certainly means some fish or fish-like animal—a swordfish, alligator, or the like, though exactly which is not certain, and probably the reference with them was altogether mythical.

Dr Seler, in his subsequent paper, gives the following explanation of the Zapotec name *chilla* or *chijlla*:

> For this I find in the lexicon three principal meanings: One is the cubical bean (wurfel bohne). "Pichijlla, frisolillos o havas con que echan las suertes los sortilegos" [beans used by the sorcerers in casting lots or telling fortunes]; another meaning is "the ridge" (pichijlla, lechijlla, chijllatani, loma o cordillera de sierra); another is "the crocodile" (cocodrillo, lagarto grande de agua); and another "sword-fish" (pella-pichijlla tao, espadarte pescado). Finally, we have chilla-tao, "the great Chilla," given again as one of the names of the highest being. Here it seems to me that the signification "crocodile" is the original one, and thus far suitable. For the manner in which the first day character is delineated in Mexican and Zapotec picture writing [our plate LXIV, 16] shows undoubtedly the head of the crocodile with the movable snapping upper jaw, which is so characteristic of the animal.

Attention is called to the apparently closely related word as given by Perez—*mech*, *ixmech*, "lagartija."

It will not be out of place here to refer to a superstition pervading the islands of the Pacific ocean, which seems strangely coincident with the conception of the physical symbol of this day. This is a mythological monster known in some sections by the name *Taniwha*, and in others as *moko* or *mo'o*.

Dr Edward Tregear[1] speaks of it as follows:

Taniwha were water monsters generally. They mostly inhabited lakes and streams, but sometimes the sea. Sometimes the beast was a land animal, a lizard, etc, but the true *taniwha* is a water kelpie.

Mr Kerry Nichols,[2] speaking of these monsters, says:

With the other fabulous creations of Maori mythology were the *taniwhas* or evil demons, mysterious monsters in the form of gigantic lizards, who were said to inhabit subterranean caves, the deep places of lakes and rivers, and to guard tabued districts. They were on the alert to upset canoes and to devour men. Indeed, these fabulous monsters not only entered largely into the religious superstitions, but into the poetry and prose of Maori tradition.

The Hawaiian *Mo'o* or *Moko* appears, from the following statement by Judge Fornander, to have been applied sometimes to this mythological monster:

The *Mo'o* or *Moko* mentioned in tradition—reptiles and lizards—were of several kinds—the *mo'o* with large, sharp, glistening teeth; the talking mo'o, *moo-olelo;* the creeping mo'o, *moo-kolo;* the roving, wandering mo'o, *moo-pelo;* the watchful mo'o, *moo-kaala;* the prophesying mo'o, *moo-kaula;* the deadly mo'o, *moo-make-a-kane.* The Hawaiian legends frequently speak of *mo'o* of extraordinary size living in caverns, amphibious in their nature, and being the terror of the inhabitants.[3]

According to the Codex Fuen-leal, at the beginning of things the gods made thirteen heavens, and beneath them the primeval water, in which they placed a fish called *cipactli* (queses como caiman). This marine monster brought the dirt and clay from which they made the earth, which, therefore, is represented in their paintings resting on the back of a fish.

A similar conception is found both in Malay and Hindu mythology, differing somewhat in details, but always relating to some monster reptile. In the Manek Maya, one of the ancient epics of Java, Anta Boga, the deity presiding over the lowest region of the earth, is a dragon-like monster with ninety nostrils. The same conception is found also among other peoples.

In the Tonga language *moco* is "a species of lizard;" in Hawaiian *mo'o* or *moko* is "the general name for lizards," and the same word signifies "lizard" in Samoan; *moko-moko* is the New Zealand (Maori) name for a small lizard. Taylor[4] says that *moko-titi* was a "lizard god."

It is therefore evident that a superstition regarding some reptilian water monster prevailed throughout the Pacific islands. It is true also that the Nahuatl *cipactli* certainly means some amphibious or

[1] Jour. Anthrop. Inst. G. B. and I., November, 1889, p. 121.
[2] Ibid., 1885, p. 199.
[3] Polynesian Race, vol. 1, pp. 76–77.
[4] Rev. Richard Taylor, Te-Ika-a-Maui; London, 1870.

water animal—a swordfish, alligator, or something of the kind, though exactly which is not certain—or, what is more likely, the reference was altogether mythical.

It is possible, and perhaps probable, as stated above, that the Maya symbol of this day was taken originally from the conventional method of representing the female breast. Drs Seler and Schellhas appear to be of this opinion. But it does not necessarily follow from this that the character used for the name of the day has any reference to the female breast, as it is more likely used in this relation for its phonetic value alone, *m* being the chief phonetic element indicated thereby.

If the supposition herein advanced that the combination shown in plate LXIV, 9, denotes bread or food be correct, it is possible that the symbol is also sometimes used to indicate "maize," *ixim* or *xim*, on account of its phonetic value. As will be shown farther on, the *kan* symbol is not only used to denote the grain of maize and maize in the general sense, but it appears to denote in some cases bread or the tortilla.

THE SECOND DAY

Maya, *ik;* Tzental, *igh;* Quiche-Cakchiquel, *ik';* Zapotec, *gui, ni, laa, laala* or *liaa;* Nahuatl, *ehecatl.*

The form of the symbol of this day presents a number of minor variations, the more important of which are shown in plate LXIV, 18–26. Symbol 18 is the form given by Landa; 19–24, those found in the codices; 25 is from the left slab of the Palenque tablet or altar plate, and 26 is from the Tikal inscription.

So far as this character can satisfactorily be interpreted, where used otherwise than as a day symbol, the signification appears to be wind, spirit, or life, whether considered phonetic or not. As illustrations of its use, the following examples are presented:

At the right side of Dres. 72e are the three characters shown in plate LXIV, 27, 28, and 29, which follow one another downward, as shown in the figure, the three forming one of the short columns of the series to which they belong. From the lowest, which is the *ik* symbol, waving blue lines, indicating water, extend downward to the bottom of the division. If these glyphs are considered ideographic and not phonetic, it is still possible to give them a reasonable interpretation. The falling water shows that they relate to the rain storm or tempest. The uppermost character, which appears to be falling over on its side, we may assume to be the symbol of a house or building of some kind;[1] the dotted lines extending from its surface may well be supposed to represent rain driven from the roof. There is, however, another possible interpretation of this character which appears to be consistent with Mexican and Central American mythology. It is that it indicates a house, vessel, or region of the heavens which holds the waters of the

[1] American Anthropologist, July, 1893, pp. 263–264.

upper world. The turning on the side would, in this case, denote the act of pouring out the water in the form of rain. This supposition (although I am inclined to adopt the former) appears to be supported by the fact that this character is used in the Dresden Codex as one of the cloud or heaven symbols, as, for example, on plates 66 and 68. According to Ramirez, the Mexican wind and rain gods occupy a large mansion in the heavens, which is divided into four apartments, with a court in the middle. In this court stand four enormous vases of water, and an infinite number of very small slaves (the rain drops) stand ready to dip out the water from one or the other of these vases and pour it on the earth in showers.[1] As the lowest character in the group mentioned is the *ik* symbol, its appropriate rendering here is beyond question "wind;" therefore, as two out of the three characters, and the rain sign below, indicate the rain storm, we may take for granted that the middle character probably refers to lightning or thunder.

Additional reasons for this interpretation are given in a previous paper[2] and need not be repeated here, as the only object now in view in referring to them is to show that the *ik* symbol is there used to denote wind.

In the third and fourth divisions of plate 16* Codex Troano, five persons are represented, each holding in his hand an *ik* symbol from which arises what appear to be the sprouting leaves of a plant, probably maize (plate LXIV, 30, 31). This is interpreted by Dr Seler as the heart just taken from the sacrificed victim, the leaf-shape figures representing the vapor rising from the warm blood and flesh. It is unnecessary to give here his reasons for this belief, as the suggestion presented below, although wholly different, gives to the symbol in this place substantially the same meaning that he assigns to it, to wit, life, vitality. It is probable that the figure is intended to represent the germination of a plant—the springing forth of the blade from the seed—and that the *ik* symbol indicates plant life, or rather the spirit which the natives believe dwells in plants and causes them to grow. Seler's suggestion that in this connection *ik* may be compared to *kan* is appropriate, but this comparison does not tend to the support of his theory. Take, for example, the sprouting *kan* symbols on Tro. 29b, to which he refers. There can be no doubt that the symbol represents the grain of maize from which the sprouting leaves are rising (plate LXIV, 32). In one place a bird is pulling it up; at another place a small quadruped is attacking it; at another the Tlaloc is planting (or perhaps replanting) the seed.

In the lowest division of the same plate (Tro. 29) are four individuals, three of whom, as may be seen by studying the similar figures in the division above, are anthropomorphic symbols of corn; the other an earth or underworld deity. One of the former holds in his hands a *kan* symbol, which is colored to signify maize; the others hold *ik* symbols. There

[1] Historia de los Mexicanos, as quoted by Brinton.

[2] American Anthropologist, July, 1893.

are two interpretations which may be given this symbolic representation—one, that the *ik* glyphs are intended to denote plant life, that which causes plants to spring up and grow; the other, that they denote wind, which in that country was often destructive to growing corn.

Very distinct reference is made in the "Relacion de la Villa Valladolid"[1] to the injurious effects of winds on the maize crop. It is related in this report, which appears to have been of an official character, made in 1579, that—

> From June till the middle of August it rains very hard and there are strong winds; from the latter date the rains are not copious and the wind blows strongly from the north, which causes much mortality among the natives, and Spaniards as well, for they contract catarrh and *barriga* (dropsy?). This north wind destroys the maize crops, which form the main sustenance of both natives and Spaniards, for they use no other bread.

There can be no doubt that most, if not all, of the figures on this plate (Tro. 29) are intended to represent the injurious and destructive agencies to which maize and other cultivated plants were subject. Birds and quadrupeds pull up the sprouting seed and pull down and devour the ripening grain; worms gnaw the roots and winds break down the stalks, one out of four escaping injury and giving full return to the planter. The latter is therefore probably the correct interpretation, the only difficult feature being the presence of the Earth god, which agrees better with the first suggestion.

It is to be observed that the series on Tro. 29c really commences with the right-hand group on 30c. The figure here holds in his hand an *ik* symbol. Following this, the left group on 29c shows a bird pecking the corn; the next, a small quadruped tearing it down; the next, a worm gnawing at the root of a plant; and the fourth, or right-hand group, a corn figure holding a *kan* symbol, indicating the mature grain, the uninjured portion of the crop. It would therefore appear that the *ik* symbol in this series denotes wind.

As additional proof that the symbol is used to indicate "wind," reference is made to Tro. 24a. Here the long-nose Rain god, or Maya Tlaloc, is seen amidst the storm, clothed in black and bearing on his arm a shield on which are two *ik* symbols (plate LXIV, 33), doubtless indicative of the fierceness of the tempest. In front of him is the Corn god, bending beneath the pouring rain. On plate 25, same codex, lower division, the storm is again symbolized, and the *ik* symbol is present here also.

It seems from these facts to be quite certain that the value of the symbol in the codices, so far as it can be satisfactorily determined, corresponds in signification with the Maya name.

Referring again to Dr Seler's theory that the plant-like figures on Tro. 15*, 16* indicate the freshly extracted heart and the vapor arising therefrom, the following additional items are noted: He says that in the text the scene below, or at least these sprouting-plant figures,

[1] Cong. Inter. des Americanistes, Actes de la Cuarta Reunion, Madrid, 1881, tom 2, pp. 173-174.

are expressed by hieroglyphs 27–29, plate LXVIII. His comparison with the so-called heart figures from the Mexican codices can scarcely be regarded as convincing, for there is hardly any resemblance. Moreover, he omits to furnish an explanation, on his theory, of the fact that some of these rising "vapors" are crowned with blossoms or fruit (plate LXIV, 31).

I think it quite probable that Dr Seler, although not accepting the theory of phoneticism, has been influenced to some extent by the form of the right-hand character of the glyph shown in plate LXVIII, 27. This is much like Landa's *o*, and *ol* in Maya denotes "heart, etc."

According to Brasseur, *oloh* signifies "a germ" and "to germinate;" *hokol* also has about the same meaning. This furnishes a consistent and appropriate explanation of the figures, and gives at the same time the phonetic value of the glyph. I have not determined the prefix satisfactorily, but presume it is some word having *ch'* or *tz'* as its chief phonetic element, which signifies "little," "plant," or something similar.

I have not determined the other symbols to which Seler alludes in this connection, but some of them, as may be seen by comparison with other passages, do not have special reference to the plant-like figures.

Whether the little sharp-corner square seen in the upper right-hand character of the compound symbols shown in plate LXVI, 28 and 55, and others of similar form, are to be taken as *ik* glyphs is yet an undecided question. Dr Seler appears to have excluded them from this category in his paper, so frequently referred to, though he subsequently brings them into this relation. But in these places he gives the glyph the signification "fire" or "flame." It is possible that in some of the cases to which he refers he is correct, as, for example, in regard to the figure shown in plate LXVIII, 30, from Dres. 25, where it is in the midst of the blaze. If so, the word equivalent must be *kak*, as it is seemingly a variant of *ik*, and hence may be supposed to have the *k* sound. This will agree with his interpretation of plate LXVI, 29, by *kinichkakmo;* but in this case we must give *ich* as the value of the so-called *ben* symbol. This, however, is not so very objectionable, as there are other places where the chief phonetic element of the *ben* glyph appears to be *i*. It is also to be remembered that it is much like Landa's *i*. It is likewise true, as will hereafter be shown, that the value *ben* does not appear to hold good where it occurs in combination with other symbols. However, until a satisfactory rendering of this little four-corner *ik* (?) symbol in some other place than the fire is found, I am hardly prepared to give full acceptance to Dr Seler's supposition.

The Zapotec names are somewhat difficult to bring into harmony with the others. Dr Brinton's solution is as follows:

> In that tongue we have *aii*, air, wind; *chiie*, breath; which we may bring into relation with *gui;* and we find *guiiebee*, wind-and-water cloud (nube con viento y agua). Dr Seler prefers to derive *gui* from *quii*, fire, flame, the notion of which is often associated with wind.

It was probably this notion and the fact that the little four-corner *ik* (?) symbol is sometimes seen in the flame, which caused this authority to believe the symbol denotes "fire," "flame." In the manuscript Zapotec vocabulary by E. A. Fuller, "wind" is *bii*.

Dr Brinton thinks that *ni* is the radical of *nici*, to grow, increase, gain life. He says:

> *Laa*, or *laala*, is a word of many meanings, as warmth, heat, reason, or intelligence. The sense common to all these expressions seems to be that of life, vitality.

The form of the Mexican symbol for the day *Ehecatl* (wind), shown in plate LXIV, 34, and also of the months of the female figures on plates 26 and 28, Troano Codex, which are emblematic of the storm, appear to be taken from the bird bill. The bird, as is well known, is a wind symbol with many peoples. It has been so esteemed among several tribes of American Indians, and also by peoples of the Old World. As *nii* or *ni* signifies "nose, beak, point" in Maya and several cognate dialects, is it not possible that in this is to be found an explanation of the second Zapotec name? In this case, however, we must assume that the term is borrowed, as in this language *xi* or *xie* is the term for "nose." I notice, however, that the name for bird is given as *riguini* and *piguiini*. If *pi* (*vi*) is a prefix, as seems probable from the word for "hen," *guitii*, then we have some ground for believing that the first Zapotec name has the same fundamental idea as the Mexican symbol.

It therefore would seem that it is not difficult to understand the origin of the Mexican symbol. Examining plate 10, Borgian Codex, which appears to represent the home of the winds, we see that, though mostly furnished with human bodies, they have bird claws as well as bills. But the origin of the Maya symbol is more difficult to account for. Dr Seler remarks:

> It is difficult to determine the original idea of this character. Figure 210 [our plate LXIV, 21] and the forms on the reliefs—if we have correctly interpreted these—lead us to think that the wind cross, or the figure of the Tau resulting from it, was the origin of the character. However, the forms of the Cod. Tro. are not easily reconciled with this.

Dr Brinton[1] asserts, without heeding Dr Seler's caution, that it is the sign of the four directions or four winds—the wind cross—evidently alluding to the sharp-corner square seen in our plate LXVI, 28. But he seems to have overlooked the fact that it is never thus represented in the day symbol. Moreover, no satisfactory proof has been presented showing that this form has this signification. Seler gives it in some places, as above stated, the signification "fire," "flame;" and if his interpretation of plate LXVI, 29 by *Kinich-kakmo* be correct, as Brinton seems to think it is, his interpretations are consistent. However, Seler's assertion that "the forms of the Cod. Tro. are not easily reconciled with this" must be admitted. In the codices this glyph, as this author

[1] Primer of Mayan Hieroglyphics, p. 115.

remarks, "rather brings to mind the idea of hanging," often resembling a bunch of grapes.

I take for granted the symbol, when standing for the day, is not pictorial or ideographic, but is adopted for its sound value. If this supposition be correct, then it must be a conventional representation of something the Maya name of which is *ik* or that has substantially this phonetic value. The form of the Mexican symbol, as above indicated, shows that in selecting it reference was had to the bird bill, to which possibly may have been added the idea of blowing forcibly from the mouth, a common method of indicating wind. (See for example the bird-mouth female, Tro. 25b, where the *Ik* symbol is present.) But it seems impossible to find in the symbol any reference to the bird, bird bill, or the act of blowing, or in fact anything indicating, even by a conventionalized figure, wind, air, spirit, or breath. Hence it is reasonable to conclude that it has been selected only because of the resemblance in sound of the thing it represents to the name *Ik*. I would be inclined to believe that the most usual form is the representation of a tooth or two teeth, the name being used for its phonetic value only, but for the very troublesome fact that I can find no name for tooth in Maya to sustain this view. If we could suppose it to be a conventionalized ideogram of an insect, we would obtain the desired sound, as Perez explains *ikel* by "bicho, insecto, polilla, gorgojo." It must, however, be confessed that none of these suggestions are satisfactory.

The following additional references to the bird as a symbol of the wind are appropriate at this point.

Not only is the day *Ehecatl* represented in the Mexican codices by a bird's head, but we see a bird perched upon a tree at each of the cardinal points on plate 44 of the Fejervary Codex. Birds are also perched on three of the four trees representing the cardinal points on plate 65 of the Vatican Codex.

In speaking of the myths of the Muyscas, Dr Brinton[1] says:

> In the cosmogonical myths of the Muyscas, this [alluding to a certain name] was the home or source of light, and was a name applied to the demiurgic force. In that mysterious dwelling, so their account ran, light was shut up and the world lay in primeval gloom. At a certain time the light manifested itself, and the dawn of the first morning appeared, the light being carried to the four quarters of the earth by great black birds, who blew the air and winds from their beaks.

The Javanese also assigned a bird to each of the cardinal points, doubtless with substantially the same mythological concept.

Commenting on a passage of the Popol Vuh, in which the name *Voc* is mentioned, the same author[2] says:

> The name *Voc* is that of a species of bird (Cakchiquel *Vaku*). Coto describes it as having green plumage, and a very large and curved bill, apparently a kind of parrot. Elsewhere in the myth (page 70) it is said to be the messenger of Hurakan, resting neither in the heaven nor in the underworld, but in a moment flying to the sky, to Hurakan, who dwells there.

[1] American Hero Myths, p. 222.
[2] Names of the Gods in Kiche Myths, p. 22.

This is unquestionably the wind symbolized as a bird. The name for wind in Malay is *bayu*, and *Vayu* is a Wind god in Hindu mythology. Garud, the Bird deity of the Hindu Pantheon, who plays such an important rôle in the Mahabharata, and is so frequently termed therein "the foremost ranger of the skies," is apparently the Storm god, the equivalent of the Maya *Hurukan*.

We may remark incidentally that a curious coincidence is found in the fact that there appears to be a relation between the wind and monkeys in the mythology both of the Hindu and of the natives of Central America, or at least of Mexico. Hanuman, the Monkey god, who plays such an important part in the Ramayana, was the son of Pavana, the chief Wind deity. According to Brasseur, in his introductory essay to the *Popol Vuh*, it is stated in the Codex Chimalpopoca that the men were, on a day *Ehecatl*, changed by the wind into monkeys. On what peculiar mythological conception this idea is based I am unable to state.

THE THIRD DAY

Maya, *akbal;* Tzental, *votan:* Quiche-Cakchiquel, *akbal;* Zapotec, *guèla;* Nahuatl, *calli.*

The form of the Maya character as given by Landa is shown in plate LXIV, 35; those usually found in the codices are presented in figures 36 and 37 of the same plate. A slight variation which sometimes occurs in the Dresden Codex is given in plate LXIV, 38. In figure 39 of this plate circular dots take the place of the teeth. In another variant, shown in figure 40, there is a row of dots immediately below the broken cross line. The forms shown in figures 41 and 42 are from the inscriptions. As will be seen by comparing figures 36 and 38 with plate LXV, 64, this glyph, in some of its forms, resembles somewhat closely the *chuen* symbol, but is generally readily distinguished from it by the wavy line across the face and the absence of the little divided oblong at the top, which is mostly present in the *chuen* symbol. The lower triangle is usually sharp and extends to the top in the *akbal* symbol, while that in the *chuen* glyph is broad or rounded and does not extend to the top.

The signification of the Maya and Cakchiquel names, and also of the Zapotec, is "night" or "darkness." The Tzental name is that of a celebrated hero, which, according to Dr Brinton, is derived from the Tzental word *uotan*, "heart" or "breast." This explanation is accepted by Seler, as Bishop Nuñez de la Vega, the principal authority regarding this mythological personage, says that "in every province he was held to be the heart of the village." Dr Seler also adds that "'heart of the village' is in Mexican called *tepeyollotl*, and that is the name of the deity of the third day character, *calli*" (plate LXIV, 46).

The Mexican name *calli* signifies house. The method by which Dr Brinton brings this and the Tzental names into harmony with the idea of darkness or night is as follows:

> The house is that which is within, is dark, shuts out the light, etc. Possibly the derivation was symbolic. Votan was called "the heart of the nation," and at

Tlazoaloyan, in Soconusco, he constructed, by breathing or blowing, a "dark house," in which he concealed the sacred objects of his cult. In this myth we find an unequivocal connection of the idea of "darkness" and "house."

Dr Seler's explanation is substantially the same; he differs somewhat, however, from Dr Brinton in regard to the derivation of the word *votan* (or *uotan*), as he obtains it from the Maya *ol*, *uol*, "heart, soul, will, etc," and *tan*, "in the midst," also "surface, level, extent, front." He concludes, therefore, if *uo* signifies heart, that *uotan* denotes "the inmost heart" or "heart of the expanse." It is proper, however, to call attention to the fact that Dr Brinton's derivation of the name in his "American Hero Myths" is slightly different from that given in his "Native Calendar," above mentioned. In the former he says *uotan* "is from the pure Maya root word *tan*, which means primarily 'the breast,' or that which is in the front or in the middle of the body; with the possessive prefix it becomes *utan*. In Tzental this word means both 'breast' and 'heart.'" It must be admitted that these explanations are apparently somewhat strained, yet it is possible they are substantially correct, as they appear to receive some support from the figures in the Mexican codices.

Plate 75 of the Borgian Codex, which is in fact the lower part of the figure on plate 76, heretofore alluded to, although having reference to the underworld, appears to be in part a delineation of night. The large black figure probably represents night, the smaller star-like figures denoting stars, and the large one the night sun, or moon. The house in the lower right-hand corner, with the black lining, is the house of darkness. The wind symbol above the roof indicates relationship with the winds. Dr Seler interprets these star-like figures as sun symbols, but the number found together on this plate forbids the supposition that they represent suns. Moreover, the association with the dark figure renders it probable that they are here used to denote stars.

There is, however, a lack in these explanations of a connecting link, which seems necessary to render them entirely satisfactory. The name appears to be intimately associated with that for serpent; or perhaps it would be more correct to say that this mythological personage appears to be intimately connected in some way with the serpent. The title of the Tzental manuscript containing the myth was, according to Cabrera, "Proof that I am a Chan," which signifies "serpent." His chief city was *Nachan*, "the house of the serpent;" his treasure house was a cavern. Simply designating him by "the heart of the nation," "heart of the village," does not appear to furnish a full explanation of his attributes or characteristics.

As the symbol of this day is frequently connected with cloud and rain-storm series, as in Tro. 25a, where it appears to be that from which rain is falling, its signification in these places would appear to be "cloud," which carries with it the idea of shade, shadow, and darkness. This being true, the most likely supposition in regard to the origin of the symbol is, that it was designed to represent the cloud breaking into drops and falling as rain—in other words, the weeping cloud. Such

appears beyond question to be its signification in Tro. 25a and in other places in the same and other codices. This supposition is also consistent with the fact that some of the symbols, especially those of the inscriptions (plate LXIV, 42), have dots along the broken line, which may indicate the raindrops into which the cloud is breaking. I am therefore not inclined to accept Dr Seler's supposition that it is intended to represent the opening to a cavern, after the conventional method adopted by the Mexican artists. It is improbable, though not impossible, that the older system may have adopted some features from the younger. Moreover, this supposition on the part of Dr Seler is in direct conflict with his statement in the immediately preceding paragraph. He says:

> It is to be observed as applying chiefly to the manuscripts and the reliefs, that the two side points which project like teeth from the inner circle of the character could in nowise have signified teeth. Such an interpretation is contradicted by the occasional change of their position [plate LXIV, 47] and the fact that they also appear now and then exactly like eyes [plate LXIV, 39].

Now the Mexican cavern symbol, as shown in his figures and as given in Peñafiel's "Nombres Geográficos," appears to be the open serpent mouth with teeth and fangs. It is therefore more probable that the symbol was derived as above indicated. Among the Indian pictographs given by Colonel Mallery[1] as representing clouds are those shown in plate LXIV, 43 and 44. An Ojibwa cloud symbol[2] is shown in plate LXIV, 45, in which the circular outline denotes the sky. It seems quite likely that the Maya symbol is intended to convey precisely the same idea. On the left (bottom) of plate 70, Borgian Codex, is a curved or arch-like figure somewhat on the same order as those given. It appears to represent the sky—but darkened sky, indicating night or obscurity. On its upper surface are nine heads, which probably signify the "Nine Lords of the Night." Below it is a black figure. On each side are two figures, the color of the four differing—one blue, another yellow, another black, and the other red. These are probably the regents of the cardinal points.

If this supposition be correct, the symbol is purely ideographic and not phonetic or ikonomatic; but this does not forbid the idea that when used in other combinations it is used phonetically to give the chief sound element of the word indicated by the ideograph. Dr Seler claims, as corroborative of his supposition, that "all symbols which are combined with the name of the third character are to be fully explained through the word 'cavern.'" But it is far more likely that this (so far as it holds good) is due to the fact that the symbol is used because of its phonetic value or its chief phonetic element, *ak*, which is the same as the chief element of the Maya name for cavern—*actun*, *actan*, *aktan* (Henderson, MS. Lexicon).

If this supposition be correct, it may furnish a clue to the name of the deity whose symbol is shown in plate LXIV, 48. Here the left-hand

[1] Fourth Ann. Rep. Bur. Eth. (1882-83), p. 238.

[2] Schoolcraft, "Indian Tribes," etc, vol. I, pl. 51, No. 10, p. 360.

character is the *akbal* symbol (though not complete) surrounded by a circle of dots. This circle, Dr Seler contends, often indicates flames which consume the object it surrounds, or light which emanates from that object. If the whole is but a simple ideogram, it must be taken, as a whole, as indicating a particular mythological personage; otherwise it is in part phonetic, or given after the Mexican rebus method of denoting names. If not a simple ideogram, this prefix is most probably used in some sense phonetically with reference chiefly to the *k* sound. The circle of dots is used here probably to indicate the vowel sound *u* or *o*. But in making this suggestion I do not by any means intend to suggest that the Maya scribes had reached that stage of advancement where they could indicate each sound by a character. All I wish to assert is that I find in numerous cases characters accompanied by this circle of dots where the proper interpretation appears to be a word having as its prominent vowel element *u* or *o*. Hence the inference that there is some relation between this circle and these vowel sounds—this and nothing more.

In Dres. 16c is the symbol shown in plate LXIV, 49. This, as I have shown elsewhere,[1] represents the *kukuitz* or Quetzal figured below the text. Here are encircling lines of dots, and in the Maya name the *u* sound repeated; and here also is Landa's *ku*. In Dres. 47c the symbol for the month *Mol* is given as shown in plate LXIV, 50. Here again is seen the circle of dots, and the vowel appears to hold good in other places. We see it in Landa's first *o*. It will also assist us in giving at least a consistent interpretation to the strange character shown in plate LXIV, 51, which occurs repeatedly on plate 19 of the Tro. Codex. In the pictures below are individuals apparently, and as interpreted by most authorities, engaged in grinding paint or other substance or in making fire. The right half of the glyph, including the circle of dots and cross-hatching might, according to the value heretofore given these elements, be rendered by *huck*, "to rub, grind, pound, pulverize;" which certainly agrees with the interpretation usually given the pictures below. Possibly the whole glyph may be interpreted by *cecelhuchah*, "to triturate." While this, so far as it relates to the left portion of the glyph, is a mere suggestion, it agrees with the fact that the ornamented or cross-barred border is found in the symbol for *Cib*, and the three dots with Landa's *e*.[2]

[1] American Anthropologist, July, 1893, pp. 258–259.

[2] Dr Brinton (Primer, etc, p. 93) explains it as the symbol of a drum. He remarks that "in a more highly conventionalized form we find them in the Cod. Troano thus [giving plate LXIV, 51], which has been explained by Pousse, Thomas, and others as making fire or as grinding paint. It is obviously the *dzacatan*, what I have called the 'pottery decoration' around the figures, showing that the body of the drum was earthenware." Yet (p. 130 and fig. 75) Dr. Brinton explains this identical group or paragraph as a representation of the process of making fire from the friction of two pieces of wood. It seems to me clear that this glyph represents something in the picture, and not the personage, as there is a special glyph for this. A comparison of the groups in the two divisions of this plate (Tro. 19) and plates 5 and 6 b of the Dresden Codex shows that the glyph refers to the work or action indicated by the pictures. That it refers to something in or indicated by the pictures, and that no drum is figured, will, I think, be admitted by most students of these codices.

In Tro. 11*d is the character shown in plate LXIV, 52. As the right portion is the upper part of the symbol for *chikin*, "west" (see plate LXIV, 53), its phonetic value may be a derivative of *kuch*, *kuchnahi*, *kuchah*, "to spin, to draw out into threads." Henderson gives *chuch* as an equivalent. As the subfix in plate LXIV, 48, is the character I have usually interpreted by *u*, this would give us some of the elements of the name *Kukulcan* and not *Itzamna*, as Seler and Schellhas suppose. Possibly, however, the deity represented may be *Baklum-Chaam*, the god adored at Ti-ho and usually considered, though without apparent justification, as the Maya Priapus.

The somewhat similar character, plate LXIV, 55, from Tro. 18*c, which Dr Seler considers synonymous, is probably essentially distinct, as it bears a somewhat stronger resemblance to the *chuen* than to the *akbal* symbol. In character 54, plate LXIV, from Dres. 17b, which denotes the vulture or rapacious bird figured below the text, it probably indicates the *c* sound, as the most reasonable interpretation of the symbol is *hchom*, "the sopilote" (Perez), or *hchuy*, "a hawk or eagle." If the character shown in plate LXIV, 54, is intended to indicate the bird figured below, and is neither of those mentioned, it is probably one the name of which begins with *ch*.

The symbol of the month *Zoo* (*Tzoz* or *Zotz*) also contains this supposed *akbal* glyph, but in the varied form last above mentioned, which, as we have said, bears a strong resemblance to the *chuen* symbol. This, as will be seen by comparing, bears a very close resemblance to glyph LXIV, 54. If phonetic, we must assume that the *ch* (if the interpretation of the former be correct) has been hardened to *z* or *tz*.[1]

The same character is also found in the symbol for the month *Xul* (see plate LXIV, 56, from Dres. 49e). As Dr Seler refuses to accept the theory that the characters are either phonetic or ikonomatic, he concludes, in the following words, that resemblance in the forms of the symbols indicates relationship in the subject-matter:

> *Xul* signifies the end, the point; *xululul*, to end; *xulah*, *xulezah*, to bring to an end; *xulub* (that with which anything ends), horns, or he who has horns, the devil; *xulbil*, jests, tricks, deviltry. We see, therefore, that this word contains doubtless a reference to something unholy, uncanny, demoniac. To the Central Americans the bat was not merely a nocturnal animal. The Popol-Vuh speaks of a Zo'tzi-ha, "bat house," one of the five regions of the underworld. There dwells the Cama-zo'tz, "the death-bat," the great beast that brings death to all who approach it, and also bites off the head of Hunapu.

Instead of having to surmise this fancied relation, I think the explanation is to be found in the fact that similarity in the form of the glyph is indicative of a similarity in the sounds of the words represented. Here the *ch* becomes *x* (sh).

Dr Seler also calls attention in this connection to the animal figures in Dres. 36a and elsewhere, which are "represented as plunging down

[1] Dr Brinton (Primer, p. 117) errs in regarding the superfix to this glyph as the *kin* or sun symbol.

from heaven with torches in their paws, and fire also issuing from the tassel-like ends of their tails, which doubtless denote the lightning, the death-dealing servant of the Chac." By the mention of this last word—*chac*—Dr Seler has shown that correct reasoning by a different line leads to precisely the same result as that which appeals to the phonetic or ikonomatic character of the symbol. Here again the *ch* sound appears as the chief element of the character. The rain or field deities, the chacs, are usually represented in the codices as dog or panther like animals; and *chuac*, "the tempest," and, according to Henderson, *chac* also, signifies lightning. But the relation of figures and phonetic value includes also the animal; *chacbolay*, "a savage tiger, a young lion" (Perez); *chacboay*, "a leopard" (Henderson); *chacoh*, "a leopard;" *chacekel*, "a tiger, jaguar;" *chac-ikal*, "the storm, the tempest." The similar figures in Tro. 32c probably symbolize the dry burning season which parches and withers the corn. The word is probably *choco*, *chocou*, or some related form.

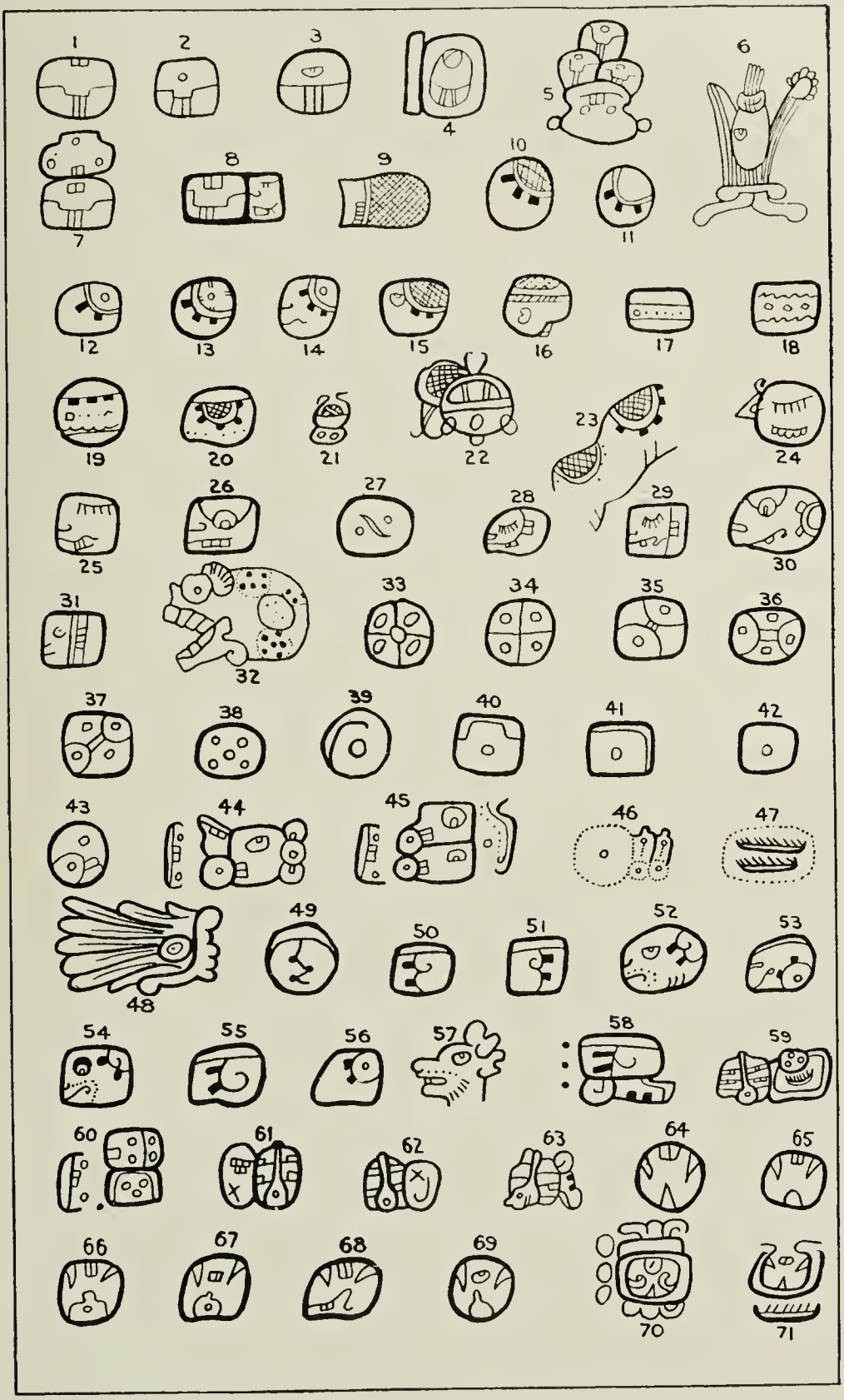
THE FOURTH DAY

Maya, *kan* or *kanan:* Tzental, *ghanan;* Quiche-Cakchiquel, *k'at* (*k'ate, k'atic, gatu*); Zapotec, *guache* or *gueche:* Nahuatl, *cuetzpallin.*

The Maya symbol of this day is subject to but few and slight variations. The principal forms are shown in plates LXIV, 57, to LXV, 3. That given by Landa is presented in plate LXIV, 57. The forms in the codices are shown in plates LXIV, 58; LXV, 1, 2, 3, that with the eye (LXV, 3) being the usual form given in Peresianus; LXV, 4 represents it as found on the right slab of the Palenque tablet.

The significations of the Maya word *kan* are various, as "yellow," "rope," "hamac," etc, and, according to Dr Brinton, the Tzental *ghanan* is the same word under a slightly different form. However, he contends that the original sense is to be found in the Cakchiquel word *k'an*, as given by Guzman (in a manuscript work in his possession), who says it is the name applied to the female iguana, or tree lizard. This, it is true, brings the signification into close correspondence with that of the Nahuatl term, but it is more than probable that the Maya and Tzental terms were in use before the application mentioned by Guzman was made by the Cakchiquel. It is noticeable, however, that in the list from Taylor's "Te-Ika-a-Maui," presented in the appendix, "lizards" are given as symbolic of one of the New Zealand days.

This interpretation, however, savors too much of an effort to bring the signification into harmony with the Mexican name. Moreover, it is difficult to explain the use of the Maya symbol on this theory, as it is undoubtedly frequently employed to denote the grain of maize. For example, it represents the seed from which a corn plant is springing, as on Tro. 29b (see plate LXIV, 32); and one figure in the same division represents a bird plucking it up, while another shows some small quadruped seizing it. It is also frequently represented in all the codices



COPIES OF GLYPHS FROM THE CODICES

as on a platter or vessel placed as an offering to some deity, and is often given a yellowish tint in these places. That the plant which arises from the symbol in these instances is the maize stalk is admitted by Drs Schellhas and Seler, although they do not seem to recognize the fact that the symbol represents the grain of maize which gives birth to the stalk. However, Dr Seler, in his subsequent paper above referred to, concludes that it refers to the seed, dropping his former interpretation. Both seem to recognize the whole glyph as a symbol of the stalk. Concerning this, Dr Seler says:

> Indeed, we see in Cod. Mendoza the maize shoot employed to express the word *acatl*, "reed." I believe that the character *kan* repeats the Mexican idea, the maize stalk. This explains for us the reason why the character *kan*, as above pointed out, always appears among the sacrifices.

I fail to understand why this authority applies the symbol to the "stalk," when it is the fruit, the ear, the grain, which furnishes food, and may therefore be very properly used as the symbol of food.

In plate LXV, 5, is presented a copy of one of these corn offerings as found on Tro. 9*b. As the vessel containing the offering appears to be a vase, pot, or olla, it seems improbable that the offering it contains should consist of maize stalks. It is true, however, that instances occur, as on plates 21–23, Troano, where the stalk rises from the *kan* symbols contained in a vessel, but these are evidently given in a figurative sense, as the vessel rests on a serpent. But even here there is evidence that the symbol denotes the grain or ear, and not the stalk, as in the lower right-hand corner of plate 21 a human figure is represented as feeding a bird with the symbol, which can not be construed in this instance as representing the stalk.[1]

Ximenes, who gives the Cakchiquel name as *cat*, says it refers to a net used for carrying maize, but means "lizard." Dr Seler, referring to this statement, says he strongly suspects that "the Mexican equivalent of this character has furnished him with this interpretation." He adds further that, in his opinion, "it has no connection with the Maya root *kan*, *kaan*, 'rope,' 'cord,' 'mat-cord,' and *kan*—Quiche-Cakchiquel, *k'an* (*gan*)—'yellow.'" He believes the Maya term is derived from *kaanan*, *kanan*, which signifies "to be superfluous," "overflow," "to abound."

Dr Brinton thinks that the Zapotec *guache*, translated by Seler "frog or toad," is more likely a variant of *guiache* or *gorache*, "iguana."

It is apparent from these widely different opinions that the signification of none of the names, save that of the Mexican calendar—*cuetzpallin*, "lizard"—has been satisfactorily determined.

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[1] Dr Brinton (Primer, p. 116) says the object represented by this symbol is "a polished stone, shell pendant, or bead." This authority considers the dot or eye in the upper part as a perforation by which it was strung on a cord. If this be true, it is strange that we see them nowhere in the codices strung on strings, though necklaces are frequently represented; and that we do see them piled up in vessels, see them putting forth shoots and leaves, and see birds and quadrupeds devouring them. Dr Brinton himself (p. 123, E. No. 29) gives one of these sprouting *kan* symbols, which he says "is a picture of the maize plant from Cod. Tro., p. 29." That it is not used ikonomatically here is evident, as *kan* in Maya is not a name for maize or grain of maize.

In attempting to ascertain the signification of the names of the day, exclusive of the Mexican calendar, it is best to exclude from consideration at first the signification of the latter, and allow it to have no influence in arriving at a conclusion. The attempt by Dr Brinton to force agreement with the latter appears to be unsatisfactory.

I am inclined to agree with Dr Seler that the Maya symbol for the day *kan* and the Mexican symbol for *tecpatl*, "flint," are based on the same fundamental concept, if the flint-like symbols on plate 12 of the Borgian Codex, one of which is shown in plate LXV, 6, are *tecpatl* figures; of this, however, there is considerable doubt. Seler's opinion is based on those of this type. There can be no doubt that here this spindle-shape figure represents the shooting plant, the central stock or stem, or, what is far more likely, the seed which gives birth to the plant. Although they occupy the position of the stock or stem, yet from the form, the fact that some of them have the eye, and that from them the roots stretch downward, I am inclined to believe they are intended to denote the seed. The *kan* symbol, as above stated, is also represented in the codices as that which gives birth to the plant, as that from which the sprouting plant springs. It is probable, therefore, that it was originally taken from the grain of maize, which it fairly represents.

Now it is well known that "yellow" is one of the primary meanings of *kan*, and that the word is closely associated with fruit, the "yellow" referring in a large degree to the ripening fruit, especially of the maize plant. According to Henderson one signification of *kan* is "ripe, as fruit, timber," and, according to Perez, *kankanil* is "sazon en [que] las frutas, aunque no esten maduras por estar las mas tomando el color amarillo." In Cakchiquel *kan* (*gan*) signifies "yellow, ripe, rich." According to Otto Stoll, *cuich* (or *cuach*), which is almost identical with the Zapotec name of the day, is the word for "fruit" in several of the Maya dialects. According to the vocabulary of Cordova, as given by Ternaux-Compans, "yellow" in Zapotec is *nagache*, and in Fuller's MS. Vocabulary it is *na-gutchi*, the *na* being a prefix signifying "thing." The anonymous author, however, writes it *brechii*. We also notice that "gold" in this language is *yache*, probably referring to the color. It is likely, therefore, that the Zapotec name of this day signifies "yellow, ripe, mature," referring to fruits, especially maize.

When maize was introduced into New Zealand it was named *kanga*, probably after the Malay *tangkai*, the name for an "ear of corn." The Meztitlan name of the day is *Xilotl*, "an ear of corn," or "a young maize shoot." These facts seem to show that the symbol has some reference to maize, and tend to confirm the view expressed above, that the compound symbol shown in plate LXIV, 9, denotes "maize bread." The presence of the *kan* character in the symbol of the month *Cumhu* or *Cumku* or *Humku* (plate LXV, 7) is difficult to explain on the theory that it retains here the signification given it as the symbol of the day *Kan*, whether considered ideographic or phonetic, unless we suppose the

name is incomplete and should have *kan* added to it. I am somewhat disposed to believe that it is sometimes used alone to denote bread, and is then to be interpreted by *uah*. Take, for example, the fignre in Tro. 30d. Here we see a dog seated on a *kan* symbol, with the same symbol taking the place of the eye. As *pek* is dog in Maya and *pecuah* the tortilla or bread of maize, and the componnd glyph in plate LXIV, 9, is in the text, this may be an instance of the trne rebus method of representing a word. Another instance of a similar character will be given under the day *Caban*. Possibly the *kan* glyph in the month symbol may have there the signification *uah*.

The fact mnst be borne in mind that this character, as before stated, is often, and perhaps most frequently, used, except where it indicates the day, merely as the symbol of corn or maize. As an example, take the compound eharacter shown in plate LXV, 8, from Tro. 33c. In the picture under the text is the Corn god represented with the dead eye and bound with cords; above his head is a dog-like animal bearing burning torches. This representation, taken in connection with what is seen in the other divisions of the plate, appears, as heretofore stated, to denote the burning drought of summer, which is destroying the maize crop. As the right portion of the componnd character is the *cimi* symbol, probably representing death, the whole character very likely indicates the dying corn. I have not found any combination where the rendering of the symbol by *kan* proves satisfactory. In fact, with the exception of the *kan-imix* combination heretofore mentioned, *kan* is very seldom combined with other glyphs, there being only some two or three in the Tro. Cod., and three or four in the Cortesian Codex. It appears, however, a number of times in combination in the Dresden Codex, but as yet I am unable to interpret any of them satisfactorily.

THE FIFTH DAY

Maya, *chicchan;* Tzental, *abagh;* Quiche-Cakchiquel, *can;* Zapotec, *ci, ziie* or *guii;* Nahuatl, *cohuatl.*

The forms in which the symbol of this day appears are varions and sometimes widely divergent. The principal ones are shown in plates LXV, 9 to 20. The form given by Landa is seen at 9; that most common in the Codex Tro. at 10. Other forms which frequently occur are shown at 11–13; those shown at 14–16 are from the Troano Codex. Some unusual forms which vary widely from the typical glyph are given at 17–20.

The change of a symbol to the face form, as seen in this instance at LXV, 15–16, does not appear to have any significance. The chief element of this character is the circular spot in the right portion, usually bordered by a double line and little square blocks, with the interior generally crosshatched. As the erosshateling is also found in the symbol for the month *Pax* (plate LXV, 22), it is probable, if phonetic, that this characteristic denotes the *x* (sh) or *ch* sound. As a similar

marking is frequently present on the serpent figures in the codices (plate LXV, 23), it is possible that its signification is *chan*, "serpent," or it may refer to some real or mythological characteristic.

The signification of the names of this day, except that of the Nahuatl calendar—*cohuatl*, "serpent"—appears to be uncertain. Perez says the word *chicchan* can be explained only by considering it to be incorrectly written for *chichan*, "little." Henderson in his lexicon writes it *chichan*, and gives as the meaning of the word, "new, young, as *chichan u*, the new moon." Dr Seler first suggested that the first part of the name might be derived from the root *chi*, *chii*, "mouth, to bite," and hence that the signification might be "the biting serpent." However, he subsequently concluded that the proper interpretation is "a sign marked or taken," from *chich*, "a sign or mark," and *ch'aan*, "something taken or carried away." Dr Brinton thinks there is much less difficulty in construing it as *chich*, strong or great, and *chan*, the generic Tzental term for serpent. The generic term for serpent in the Zoztzil is *cham*.

Dr Seler does not attempt an explanation of the Tzental term, but Dr Brinton says that it means in that dialect and in Cakchiquel, "luck, fate, fortune." This, he says, is identical with the Zapotec *ci*, *zii*, and *guii*, and, as he finds evidence that the serpent is mentioned as an animal whence portents were derived by the Zapotecs, thinks this furnishes the connecting link with the signification in other calendars. This explanation is so circuitous, and in fact strained, as to render it unsatisfactory.

A study of the symbol with reference to its origin may perhaps furnish some aid in arriving at the true signification of the name. As will be seen by reference to the various forms of the symbol, the bordering of the circular inclosed space appears to be more permanent than the inner markings. This is apparent from the fact that the little squares or blocks are retained in all the types except the anomalous forms shown in plate LXV, 16–18, and even in one of these (LXV, 18) they appear. On the other hand, the markings in the inclosed space are varied, and in some instances, as LXV, 11, are omitted altogether. It would seem, therefore, from this that the bordering was considered the essential element of the glyph. From what, then, is the symbol taken? If we turn to Dresden 25c, we see in the priest's robe, in all probability, that from which the symbol was derived. Here we have the inner crosshatching and the little dark blocks or squares around the border. The same pattern is seen also on Tro. 16*b and c, and on the female dresses, same codex, 20*c and d. On the latter, in some cases, is the waved line seen in the unusual forms of the day symbol shown in plate LXV, 17, 18, and 19. Other examples could be referred to, but attention is called only to one more, viz, the curtain-like articles exhibited on Tro. 29*b, where we see not only the inner crosshatching and bordering blocks, but on the side borders the precise marking of the day symbol shown in plate LXV, 17.

As *chi*, *chii*, signifies not only mouth, but also "limit, border, margin, shore," and especially the "skirt or loose edge of a garment," the relation of the symbol to the name of the day is obvious. It is used here for its phonetic value—*chi*. As *chii* signifies "to bite, prick, to sting as a serpent," and *chan* denotes "serpent," the true explanation of the name of the day would seem to be "the biting or stinging serpent." This will perhaps justify us in supposing that where the symbol is found on a serpent it must have reference to this characteristic.

I had not observed when the above was written that Brasseur had expressed substantially the same view in regard to the origin of this symbol.

THE SIXTH DAY

Maya, *cimi;* Tzental, *tox;* Quiche-Cakchiquel, *camey:* Zapotec, *lana;* Nahuatl, *miquiztli.*

Landa's symbol for this day is shown in plate LXV, 24. The usual form in the Codex Tro. and Cortesian Codex is given in LXV, 25; it is varied frequently by an extension of the line from the mouth, somewhat as in symbol 28 of the same plate, which is the usual form in the Dresden Codex. A variation of this is seen at 29, which seems to have given rise to the unusual form shown in 31. A radical variation is that given at 27. The symbol of the Death god, 26 and 30, is sometimes, though rarely, substituted as the symbol of this day. The closed or dead eye and prominent teeth, as seen in the usual forms, show very clearly that the symbol is simply a conventional representation of the naked skull. The form shown at 27, however, is more difficult to account for; reference to it will be made farther on.

The Maya, Quiche Cakchiquel, and Nahuatl terms signify "death." The Tzental name *tox*, however, presents a difficulty not readily overcome in order to bring its signification into harmony with that of the others. Dr Seler does not attempt an explanation in his paper on the meaning of the day names, and in his subsequent article fails to reach any settled conclusion. Dr Brinton thinks it means something (as a human head) separated, sundered, cut off; "hence *tox-oghbil*, the ax or hatchet; *q-tox*, to split, divide, cut off." In this, he holds, it agrees precisely with the Zapotec *lana*, which, he says, the Zapotec vocabulary renders "a separated thing, like a single syllable, word, or letter." Dr Seler's interpretation of the Zapotec name is wholly different, as he says that the most natural of the various significations given is, in his opinion, "hare;" *pela-pillaana*, "liebre animal;" *tooquixe-pillaana*, or *pella-pillaana*, "red para liebres." I observe, however, that in Fuller's vocabulary *gu-lana* is "to steal." Other significations are "name," "flesh," "secretly," etc. The proper interpretation of the Zapotec name therefore appears to be very doubtful. In Cordova's vocabulary, as given by Ternaux-Compans, "fleche" is given as the

meaning of *quii-lana*. In Tzotzil *gtox* signifies "to split, break off, break open, to chop." In Maya we have *tok*, which, as a substantive, Perez explains by "pedernal, la sangria;" as a verb it signifies "to bleed, let blood." In this dialect *tox* denotes "to drain, draw off liquor, spill, shed."

The usual form of the Mexican symbol for this day is shown in plate LXV, 32. It is also a naked skull.

Like Dr Seler, I am compelled to admit that I can give no satisfactory suggestion as to the origin of the form shown in plate LXV, 27. According to Colonel Mallery,[1] one sign among the Indians for knife is to "cut past the mouth with the raised right hand," which, if figured, would probably bear some resemblance to the marks on this symbol.[2]

THE SEVENTH DAY

Maya, *manik;* Tzental, *moxic;* Quiche-Cakchiquel, *queh;* Zapotec, *china;* Nahuatl, *mazatl.*

The symbol for this day, shown in plate LXVIII, 31, is without any change worthy of notice, the only difference observable being a greater or less degree of perfection with which it has been drawn by the aboriginal artist. It is found, however, in various combinations where it is subject to variation in form, if these in truth be intended for this symbol. As Brasseur de Bourbourg has suggested, this appears to have been taken from the partially closed hand, where the points of the fingers are brought round close to the tip of the thumb. Whether intended to show the palm or back outward is uncertain, though apparently the latter. The nearest approach I find among the Indian signs figured by Colonel Mallery is that denoting "little, diminutive, small." But the position of the hand in the symbol appears to indicate the act of grasping; either signification gives *ch* as the chief phonetic element of the Maya word *chan* and *chichan*, signifying "little," and *chuc*, *chucah*, "to grasp, to seize" ("alcanzar, asir, prender," Perez); or *chuuc*, "to take, grasp, catch, seize," Henderson.[3] It would seem from this that if the symbol is phonetic in any sense, the chief element of the word indicated is *ch*. The supposition by Drs Schellhas and Seler that this symbol sometimes contains the elements of the sign of the four winds or wind cross, appears to be without any real foundation. The partial cross-shape figure in it is merely the conventional method of drawing the opening between the fingers, and would be just as correctly given as an oval as an inverted tau.

As this interpretation of the symbol is quite different from that given by other writers, some evidence to justify it is presented here.

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[1] First Ann. Rep. Bur. Ethn., p. 386.

[2] Dr Brinton (Primer, p. 65) says: "Former students have been unable to explain this design" and suggests that it is a maggot.

[3] Brinton follows Brasseur in supposing it represents the "grasping hand," and thinks it is a rebus of *mach*, "asir, tomar con los manos."

Attention is called first to the symbol for "west," shown in plate LXIV, 53. The lower portion is the recognized symbol for *kin*, "day" or "sun," and the upper portion is beyond question the *manik* character. As *chikin* is the Maya name for "west," we are justified in assuming that here at least this *manik* symbol is to be interpreted by *chi*, and is in some sense phonetic. As *china* is the Zapotec name of the day, and signifies "deer," and *chigh* is the Zotzil name for "deer," it is probable that the symbol preserves the old name, while in Maya this old name has been supplanted for some reason, or through some linguistic process, by *manik*.

Dr Seler calls attention to the character shown in plate LXVIII, 32, from Dres. 13c, which is repeated in the form LXVIII, 33, on plate 21b. That this refers to the deer figured below must be admitted, as this is clearly shown by the relation of the characters in the adjoining section to the animals figured below the text. Henderson (MS. Lexicon) gives *xolke* as "the male deer." If this could be considered substantially equivalent to *cholceh* in sound, our *manik* symbol would retain its value. The objection to this supposition is that the figure is probably intended for a doe instead of the male. Brasseur gives *chacyuc* as the name applied to a small species of deer. It is true these interpretations leave out the numeral prefix; nevertheless they serve to show that it is probable the true name is a word which retains the phonetic value of the *manik* symbol as we have given it. Be the word what it may, two conclusions may be relied on: First, that it alludes to the deer, and, second, that one of its chief phonetic elements is *ch*. The character shown in plate LXVIII, 34, from Tro. 11*b, has probably the same element in its phonetic equivalent, for the Maya verb *hax* (*haxnahi*), "to twist or turn by rolling the thing between the palms of the hand; make cord used for muslin or cloth," etc, gives substantially this phonetic equivalent.

The character shown in plate LXVIII, 35, from Dres. 10b, is referred to by Seler as indicating an offering to the gods. In this he is possibly correct. As *tich*, in Maya, signifies an "offering," "a sacrifice," and *tich* (*tichah*) "to offer, present," etc, it is probable that in this instance also the *manik* symbol retains *ch* as its chief phonetic element. However, I am inclined to believe it refers to the collecting or gathering of the ripened fruit. In this case the prefix must be understood as a determinative indicating piling or heaping up, putting together or in a heap, or storing away. Of the Maya words indicating this operation, we note the following: *Chich* (*chichah*), *hich*, and *hoch*, each of which has *ch* or *ch* as its chief consonant element. This interpretation agrees very well with the fact that here, as elsewhere, a date is to be taken into consideration. On such a date, at such a time, the cacao is to be gathered, is to be harvested and stored away. Students of these codices, in their attempts at interpretation, appear, as a general thing, to overlook the fact that almost every paragraph or group of glyphs in the script is

accompanied by a date which must be taken into consideration in the interpretation. The symbol which follows immediately to the right, shown in plate LXVIII, 36, may be rendered *cacau*, the "cacao," as the duplicated comb-like character is Landa's *ca*.

As the Quiche-Cakchiquel, Zapotec, and Nahuatl names all signify "deer," the difficulty in bringing all into harmony lies in the Maya and Tzental names. Dr Seler's explanation is substantially as follows: That the word *manik* is from the root *man* or *mal*, which signifies "to pass quickly;" *manik* may therefore mean "that which passes by," "that which is fleeting." Dr Brinton gives the same explanation, and concludes that the deer is referred to metaphorically. In regard to the Tzental name *moxic*, Dr Seler suggests that it may be founded on the root *max*, from which is derived *maxan*, "swift." Dr Brinton objects to this derivation, as *maxan* with the signification "swift" is from *ma*, "not," and *xan*, "slow, tardy," and suggests that the name is probably a corruption of the Nahuatl *mazatl*. However, it may be stated in favor of Seler's explanation, that Henderson gives *moxan*, "quickly, shortly, without hindrance," which is apparently another form of *maxan*. Dr Seler, however, concludes, from a study of the relations in which the character is found in the codices, that it is the symbol of offering, of sacrifice, the deer being esteemed the animal most appropriate for this purpose. Henderson says *manik* signifies "calm," evidently considering it to be formed of *ma*, negative, and *ik*, "wind."

It is evident, therefore, that the authorities are at sea in regard to the signification of the Maya and Tzental names. If the symbol is used, as Seler claims, to indicate offerings or sacrifices, this may be readily explained on the supposition that it is used ikonomatically because of the phonetic value I have assigned it; but otherwise it is difficult, if not impossible, to see any relation between the symbol and the name given it. So far I have found it used in no place, in combination, where the value *manik* will give a satisfactory interpretation.

The following additional renderings are added here as tending to confirm the phonetic value assigned the *manik* character.

The character shown in plate LXVIII, 37, is from Tro. 20*c, where it is repeated four times. The figures below the text show women in the act of sprinkling or pouring water on children. Whether this be considered a religious ceremony or not, it is probably intended to denote purifying or cleansing, and not baptism in the modern acceptation of the term. As *choah*, according to Perez, signifies "to cleanse, purify, scour," and *choich* "to clean, scour, or wash the face," we have therein a quite appropriate interpretation of the symbol. The presence of the cardinal-point symbols renders it probable that the scene refers to a religious ceremony of some kind. The strict regard paid to the position relative to the cardinal points by savage and semicivilized people is too well known to require any proof here.

On Tro. 34*c two individuals are engaged in some work which we might suppose to be weaving but for the fact that there is no cord or

thread to be seen. Over each is the character shown in plate LXVIII, 38. This is evidently an incomplete *manik* symbol. As the supposed aspirate sign is present, it is probable that *hooch*, "to pare off, to scrape," or *hoochci*, "to pare off, or scrape the hennequin," will furnish an appropriate rendering.

THE EIGHTH DAY

Maya, *lamat*; Tzental, *lambat*; Quiche-Cakchiquel, *canel* or *kanel*; Zapotec, *lapa* or *laba*; Nahuatl, *tochtli*.

The various forms of the symbol of this day are shown in plates LXV, 33 to 37, and LXVIII, 39–40. That given by Landa is seen in LXV, 33; it is also found very frequently in the codices as LXV, 34. The three other forms found in the codices are shown in LXV, 35, 36, 37. The form on the Palenque Tablet is given in LXVIII, 40; that of the Tikal inscription is similar to Landa's figure, if we are correct in our determination, of which there is some doubt, as the dots are effaced.

A comparison of plate LXV, 36, with the symbol of the day *Ahau*, shown in LXVIII, 5, leads at once to the impression that the former was derived from the latter, and that, if in any sense phonetic, the equivalents of the two are closely related. As will be shown hereafter, the *Ahau* symbol has *l* as its chief phonetic element, if it be considered in any sense phonetic. We should therefore expect to find, in the verbal equivalent of this *Lamat* symbol, *l* as a prominent element. In the form shown at LXV, 33, it would seem that we see an effort to intimate by the character itself the presence of the *b* element. That the symbol shown in plate LXV, 38, has *b* as its chief element is shown elsewhere. It is possible, therefore, that this *Lamat* symbol had no original signification purely its own, but that it is a composite derived from the *Ahau*, and what I have termed the *b* symbol. Without anticipating the proof that the *Ahau* symbol has *l* as its chief phonetic element, I call attention to the fact that it is the upper character in the symbol for *likin*, "east" (plate LXVIII, 12). As the lower character is the well-known symbol for *kin*, "day" or "sun," we must assume that the value of our *Ahau*, in this case at least, is *li*. As another suggestion, I would add that it may have been derived from a figure used in some game. As the figure is usually divided into apartments or cells, most of which inclose a dot, the Maya word *lem*, *lemah*, "meter, encajar, poner dentro, introducir" (Perez), would not inappropriately express the idea. Its use as a day symbol would then be simply for its phonetic value. This is based, of course, on the derivation I suggest below. Nevertheless it must be admitted that these are but mere guesses.

In his article so frequently referred to Dr Seler has little to say in regard to the signification of the names of this day. He remarks that "the word *kanel* is given by Ximenes—with what authority I know not—with the signification 'rabbit,' thus corresponding to the Mexican name for this character (Tochtli)." He says he is unable to interpret the words *lambat* and *lamat*. In his subsequent article he interprets

the Zapotee word by "to divide, to break into pieees," and remarks "that the eoneept of something divided, broken in pieees, lies at the foundation of the delineation of this day character is also proved by the Maya hieroglyph for the same [see plate LXV, 33 and 36], in which something divided or broken up is undoubtedly indieated." He adds that "perhaps also the terms *lambat* and *lamat*, used in Tzental-Zoztzil and in Maya for the day eharacter, and whieh are hardly explainable from the well-known Maya, are derived from the Zapotec word *lapa*."

Dr Brinton's explanation is as follows:

> The Maya *lamat* is evidently a shortened form of the Tzental *lambat*, which is composed of *lam*, to sink into something soft ("hundirse in cosa blanda," like light loam), and *bat*, the grain, the seed. and the name refers to the planting of the crops. The Quiehe-Cakehiquel *kanel* is the name of the Guardian of the Sown Seed, probably from *kan*, yellow, referring to the yellow grains or maize. The Zapotec *lapa* or *laba* means a drop, and a crown or garland; here probably the latter, in reference to the produets of the fields. The rabbit, in Nahuatl, is the symbol of ease and intoxication.

Thus, while Dr Brinton explains the name by "sinking in the mud or soil," Brasseur explains it by "sinking in the water."

It is mneh more likely that the Maya name is but a modification of *lemba*, whieh, as a verb, aeeording to Henderson, signifies "to flash, to shine, etc:" and as a noun, aecording to Perez, "resplendor, brillo, relampago." I have no Tzental voeabulary at hand, but observe that in the elosely allied Zoztzil, "relampagear" is given as the eqnivalent of *lemlaghet*.

It is a eoincidence worthy of a passing notice that in Hawaiian *lama* and *pu-lama* signify "a torch;" *au-lama*, "to give light;" *malama*, "light from the sun or moon;" in Samoan, *lama*, "the candle-nut tree, and a toreh made of the nuts;" in Tonga, *mama*, "light, a flambeau;" New Zealand, *rama*, "candle, light;" Tahaitan, *rama*, "a toreh."

It is somewhat singular that Dr Brinton, after his interpretation of the Maya name of the fourth day heretofore given, shonld in this instanee derive *kanel*—the Quiehe-Cakehiquel name of this day—from *kan*, "yellow," referring to the yellow grains of maize. However, it is qnite probable that the reference to the eolor in this explanation is correet.

The traditions of the Indians in whieh the rabbit is brought into relation with the snn are well known. Dr Brinton has shown in his work on "American Hero Myths" that the Rabbit or Great Hare in the Algonquian myths symbolized "light." He remarks in "The Lenape and their Legends" that—

> The familiar Algonkin myth of the "Great Hare," which I have elsewhere shown to be distinctively a myth of Light, was also well known to the Delawares, and they applied to this animal, also, the appellation of the "Grandfather of the Indians." Like the fire, the hare was eonsidered their ancestor, and in both instances the Light was meant, fire being its symbol, and the word for hare being identical with that of brightness and light.[1]

[1] Page 66.

It is possible that the Mexicans selected the rabbit for this day as a known symbol of light, thus bringing it into correspondence with the signification of the day names of the other calendars. The method by which Drs Seler and Brinton try to bring the Maya and Zapotec names into harmony with the Mexican appears to me to be in the wrong direction.

It is therefore quite probable, from what has been shown, that the Maya, Tzental, and Quiche-Cakchiquel names refer to light, flame, or the lightning flash, and that the rabbit was selected because of some mythological relation it was supposed to bear to the sun, or light.[1] As this character is seldom found in combination, or used otherwise than as a day symbol, it is probable that the signification is represented by some other symbol, or is not referred to in the text.

THE NINTH DAY

Maya, *muluc;* Tzental, *molo* or *mulu;* Quiche-Cakchiquel, *toh;* Zapotec, *niza* or *queza;* Nahuatl, *atl.*

There are but few and slight variations in the form of the symbol of this day. That given by Landa is shown in plate LXV, 39. The usual forms in the codices are seen at 40–42 of the same plate. Symbol 43, which is an important variation, is from the Cortesian Codex.

The addition of the little circle and loop in example LXV, 43, from the Cortesian Codex, is important, as it possibly indicates that the simple forms given in plate LXV, 40–42, are incomplete, and may be a slight indication of phoneticism. If the latter supposition be correct, it is probable that in this additional feature we find the element *'c* of the word. It is one of the characteristics of the *manik* symbol, which, as heretofore shown, has, in some instances at least, *ch* as one of its phonetic elements, whether considered truly phonetic or not.

This clue, if followed up, appears to furnish an explanation of some other characters in which the little circle and loops are found. For example, the character shown in plate LXV, 44 (Dres. 2 (45)b and c), apparently refers to the act of sewing or stitching indicated by the pictures below the text. As the circle and loops form an important part of the character, it is probable that *c* or *ch* is the chief or prominent element of the word. It is possible therefore, that *chuyah*, "to sew," or some derivative thereof, would be a proper rendering. The glyph shown in plate LXV, 45, from Tro. 11*c is a duplication of LXV, 44. As the appendix, as shown elsewhere, probably has *ah*, *ha*, or *hal* as its phonetic equivalent, we have, as the elements of the word represented by the whole glyph (omitting the prefix), *ch'-ch'ah*. As *choch* (*chochah*), Perez, and *chooch* (*choochah*), Henderson, signify "to loosen, untie, disunite, detach," this may be the true interpretation of the symbol. The presence of the eye in a symbol appears, as a rule, to have no special

[1] Notwithstanding his definition given above, Dr Brinton suggests in his late work that the symbols of the day bear a close resemblance to some of the sun signs.

significance, as is shown by its presence sometimes in the symbols for the days *chicchan* and *oc*. It is worthy of note that Dr Seler introduces into his manik series the character above shown as having some relation to and being possibly a variation of that symbol. Before attempting to trace the symbol of the day in its combinations with other characters, with a view of ascertaining its orignal signification, reference will be made to the signification of the day names in the different calendars.

The signification of the Nahuatl word *atl* is water; the Zapotec names are also words for water. *Tohil* was the name of the principal Quiche deity, and appears to have been the god of thunder and rain, and, as Seler presumes, was the representative in these nations of the Maya Chac and Mexican Tlaloc. According to Brasseur, *toh* signifies "a heavy or sudden shower" or "thunder shower." Drs Seler and Brinton both derive the Maya and Tzental names from the radical *mul* or *mol*, "to join together, collect, heap up," and suppose it refers to the gathering together of the waters (that is, the clouds) in the heavens. This brings the signification of these two names into harmony with that of the names of the other calendars, and is probably a correct interpretation.

There are but few places where the symbol of this day is found in connection with other characters that I have been able to interpret entirely satisfactorily.

The compound character shown in plate LXV, 46, is from Dres. 16c. Judging by the evident parallelism of the groups in this division, this character is the symbol of the bird figured below the text. In this picture is easily recognized the head of the parrot. As *moo* is the Maya name of a species of parrot ("the macaw"), and the circular character of the glyph is like the symbol for *muluc*, except that the circumscribing line is of dots, we may safely accept this term as the phonetic value. The fact that the small character is double, as is the *o* in the word, is another indication that the rendering is correct, and probably accounts for the circle being of dots. (See above under *akbal*.) This interpretation appears to be further supported by the form of the symbol for the month *Mol* as found at Dres. 47c. (See plate LXIV, 50.)

The hint furnished by these characters may enable us to gain a correct idea of the signification of the dotted line which surrounds one of the characters in each group of Dres. 7c, one of which is shown in plate LXV, 47. As the inclosing line of dots appears in some cases (but not all, for in some instances *o* or *u* appears to form the chief phonetic element) to indicate *mo* or *mu*, it is possible that this glyph may be properly interpreted by *muhul*, "a gift, dower, present," or "to present a gift or dower, to offer a present." Hence the whole character shown in plate LXV, 47, may be interpreted "to make a gift of cacao."[1]

[1] For explanation of the inclosed comb-like characters, Landa's *ca*, see Sixth Annual Report of the Bureau of Ethnology, page 355.

The usual form of the Mexican symbol of this day is shown in plate LXV, 48, the leaf-like portion being blue in the original to indicate water. In regard to the origin of the character, Seler remarks: "If the Maya character agrees with the Mexican (*atl*), we must look upon it as a water vessel." Yet after a number of illustrations and references he declares: "I by no means affirm that the *vessel* is expressed by the form of this character. The form seems to me to express rather the water drop."

It is more likely that it represents a little circular hillock, seen from above, or something of that nature surrounded by a ring, as the significations given the Maya-word *mul* are "hillock, heap, mound, mountain, ants' nest, etc." However, if Henderson is correct in giving as one of its special meanings "out of many one," its origin may readily be seen. That it was taken from some object which could be designated by the word *mul* or *mol* may confidently be assumed. Hence the symbol is used for its phonetic value as a day character and not with any reference to the object represented. The little circle and loops seen in plate LXV, 43, from the Cortesian Codex 30b, are probably, as heretofore stated, introduced to give the *c* sound. Dr Brinton suggests that it represents one thing in another of the same kind, with a reference to collecting together or heaping up.

THE TENTH DAY

Maya, *oc;* Tzental, *elab;* Quiche-Cakchiquel, *tzi;* Zapotec, *tella;* Nahuatl, *itzcuintli.*

The symbol of this day as given by Landa is shown in plate LXV, 49. This is substantially the usual form found in the codices as given in LXV, 50, 51, 55, the first two being usual in the Troano, Cortesian, and Peresian codices, and 55 in the Dresden. In a few instances, as Tro. 12a and 12c, it assumes the face form 52. The face form shown at 54 occurs in the Dresden Codex, as do the variations seen at 53 and 56.

Dr Seler and Brasseur contend that the forms shown in plate LXV, 52 and 54, make it evident that the broken line, which is the chief characteristic of the glyph, is intended to represent, or rather is derived from, the ear of the dog. This, Seler says, is frequently represented in the Mexican codices, and also many times in the Maya manuscripts, with the tip of the ear torn away. To illustrate this, he presents several figures of dog's heads, one of which is shown in our plate LXV, 57.[1]

There would seem to be some foundation for this supposition, yet there are difficulties in the way of its acceptance which appear unsurmountable. The first of these is that it furnishes no explanation or clue to the relation between the symbol and the Maya or Tzental name. Second, it does not appear to have been used in any instance as the symbol of the dog, which seems to be a fatal objection, if it is assumed to be merely ideographic. Third, it renders only more difficult any explanation of the character shown in plate LXV, 58, which is of such

[1] Brinton thinks that in some of the forms it indicates "a trail" or "footprints," which are meanings of *oc*.

frequent occurrence in all the codices. If a satisfactory interpretation of this glyph could be found, it would assist greatly in deciphering the codices. I am rather inclined to think it is a sign of repetition—as "repeat thrice." If there were some word for *ear* which could be connected with *oc* or *elab*, then we might suppose the symbol to be used phonetically. However, as this can not be found, some other explanation must be sought.

The Nahuatl and Quiche-Cakchiquel names are the ordinary terms in these languages for "dog," and the Mexican symbol for the day is the head of a dog. Dr Seler does not attempt to explain the Tzental name, and merely suggests that the Maya word *oc*, "foot, footprint, track," and as a verb, "to enter, to go into," may have been adopted by the priests as expressing a prominent characteristic of the dog. Dr Brinton is inclined to derive the name *oc* from the verb *ocol*, *oclah*, "to steal, to rob," rather than from *ocol*, "to enter," supposing it to have been selected as indicative of another characteristic of the dog. This he believes also to be the signification of the Tzental term *elab*. This it seems to me is again reversing the order, unless we assume that the Quiche *tzi* and Mexican *itzcuintli* are the older terms.[1]

Dr Brinton says that according to Bartolomé de Pisa the Zapotec name signifies "dog," though he does not find it with this meaning in the vocabularies. Dr Seler, however, obtains the signification "dog" for this name by supposing that it is derived from *tee-lao*, "mouth downward," referring to some myth of a dog representing the lightning, or lightning demon, as falling or plunging downward from the sky in certain figures of the codices. This, Dr Brinton says, "seems strained," which may also be said of the explanations of the Maya name.

The symbol of the dog as found in the Dresden Codex (13c), and as admitted by Dr Seler, is shown in plate LXV, 59. The same symbol is found in the same codex, 21b. Now, I think it possible to show, with a considerable degree of certainty, what is the chief phonetic element of this symbol, at least of its first or left-hand character. In plate LXV, 60, from Tro. 22*a, is seen (omitting the prefix) substantially the symbol that Landa interprets *le*, "the lasso," and also "to lasso." As the lower character is his *e*, we may take for granted that the upper portion indicates the *l* sound; further evidence of this, however, will be presented under the twentieth day. As this is followed by the symbol seen in plate LXV, 61, which refers to the "turkey" (kutz or cuitz),[2] and the figure below the text shows a snared turkey, the interpretation appears to be appropriate. Turning now to Dres. 44 (l)e, we notice in the picture below the text the compound glyph shown in plate LXV, 62.

[1] I was not aware that *oc* had the signification "dog" in any of the Mayan languages, nor do I find that Seler or Brinton appeal to this fact in their efforts to explain the day name in the Maya calendar. However, Dr Brinton remarks that Brasseur and Seler think that some forms of the symbol "portray the ears of a dog, as in some of the Mayan dialects the dog is called *oc*."

[2] Dr Brinton (Primer, p. 95) says that this is called "an article of food, by Thomas." While this is correct in the sense that I speak of the turkey (*kutz* or *cuitz*) as food, it is incorrect in giving the impression that I interpret the symbol by "article of food," as I have always interpreted it "turkey."

Immediately below it is the figure of a fish, which the two individuals represented are trying to eateh in a seine. As this contains the same elements as 61 (plate LXV), reversed, the phonetic value should be *tz'c*. Referring to Perez' Lexicon, we find that *tzac* is a fish "so named;" Brasseur says, "a little fish resembling a sardine which inhabits the senotes."

Now these give *tz'* as the chief phonetic element of the left charaeter of the dog symbol (LXV, 59), which is also the consonant clement of the name for "dog" (*tzi*) in the Tzental, Cakehiquel, and most of the Maya dialects, though not of the Maya proper. This furnishes a consistent and appropriate rendering of the left portion of the symbol. Although the symbol for the month *Kankin* (LXV, 63) presents a diffieulty, it is possible some other name was applied to this month of which *tz* was a leading element; Yaxkin is sometimes written with the prefix *Dze*.

As *och* is the Maya name for the "male fox," and *oquil* or *ocquil* is the name in Tzental and Tzotzil for "wolf," it is possible the Maya name may have been derivcd from one of thcse. Morcover, it is worthy of notice that "foot" in Tzotzil is written *oquil* as well as *oc*.

I was at first inclined to adopt Dr Seler's suggestion that the distinguishing feature of the symbol might have been taken from the dog's ears as given in the codices. However, a more thorough examination leads mc to doubt this suggestion. The little black dots or blocks on the bent line appear here, as in the *chicchan* symbol, to be the most prominent and essential elements of the symbol. As they do not appear in the ear figures, it seems impossible that the eharacter should have been derived from these figures. It is more likely that they represent the knots on a string or cord; and this supposition appears to be sustained by the fact that the Maya word *hok*, aecording to Brasseur, signifies "a knot, hook;" and *hokal* "to be knotted, formed of knots." Perez says "*hok*, el lazo formado para anudar;" "*hokol*, lazarse para anudarse la cuerda." If this supposition be correct, the symbol is used for the day because of its phonetic value, and without any reference to its original signifieation.

THE ELEVENTH DAY

Maya, *chuen;* Tzental, *batz;* Quiche-Cakchiquel, *batz;* Zapotec, *loo;* Nahuatl, *ozomatli.*

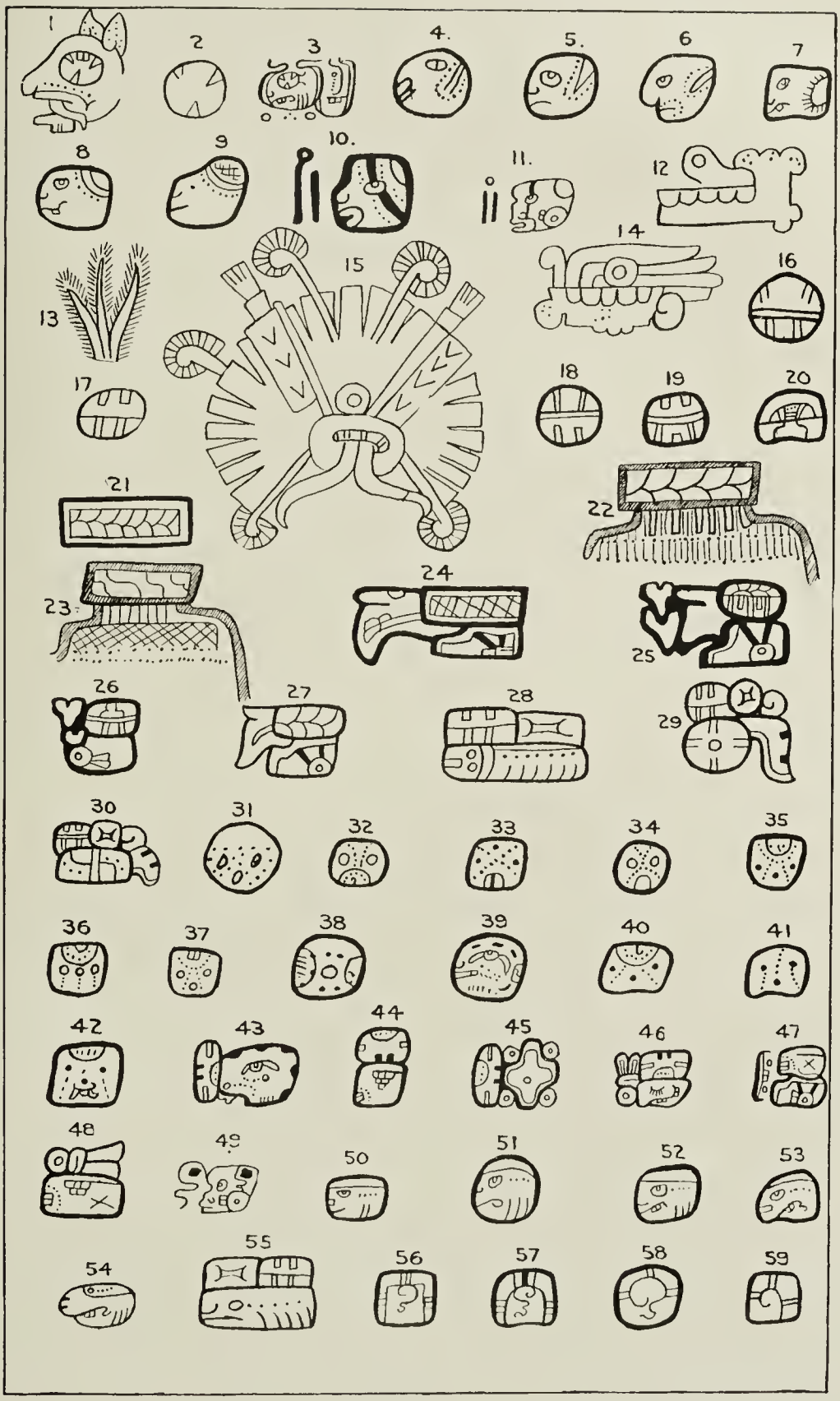
The symbol of this day is subject to few and slight variations. The form given by Landa, which is also quite common in most of the codices. especially Tro. and Cort., is shown in plate LXV, 64. Slight variants are shown in LXV, 65, 66, and 67. An exceptional and peculiar form from Dres. 32b is seen in LXV, 68. A form from the Perez eodex in which an eye is introduced is given at LXV, 69. The character on the Palenque Tablet and some other inscriptions, which is supposed to be the symbol of this day, is shown at LXV, 70, but the proof that it is, in these eases, the day symbol is not so conclusive as that in regard to

other day symbols, as no method of bringing it into relation with the other time symbols of the inscriptions has been found.

A closely corresponding form is seen in the symbol for the month *Tzec* as found in the Dres. Codex (see plate LXV, 71). If the glyphs are in any sense phonetic, it is probable that in the comb-like appendage to this symbol (Landa's *ca*) we have the *'c* (*'k*) sound, and that the variation in the main character from the usual *chuen* glyph (in having the bounding line open and turned right and left at the top) is indicative of the variation in the phonetic value. The explanation of the symbol, which replaces the eye in the dog or panther like figure in Tro. 32c and 33c, and is alluded to by Dr Seler in this connection (LXVI, 1), has already been given under the discussion of the "Third Day." There, as I have shown, it probably indicates the Maya word *choco*, "heat, warmth," alluding to the hot, dry season which parches and shrivels up the growing corn. This explanation retains the phonetic value of the symbol, and it appears also to be entirely consistent with the figures found in connection with it.

There is another symbol closely allied in form (plate LXVI, 2) which is of frequent occurrence in the codices, usually, and, in fact, almost exclusively, in the picture spaces, and apparently bearing some relation to the offerings. It is often in groups, and is many times repeated in groups on the so-called "title pages" of the Tro. and Cort. manuscripts. It, however, frequently occurs in the form seen in the dog's eye (LXVI, 1), grouped as the other (Dres., 25a, etc) and undoubtedly used as an equivalent, as we find numerals attached as with the other form. The only distinction, as will be observed, is the presence or absence of the little divided square at the top. As that with the divided square is more detailed, it is probably the correct form, and, if so, can not be distinguished from the *Chuen* symbol.

On Dres. 29b, 30b, and 31b the symbol shown in plate LXVI, 3, is found in each group of characters. This bears a close resemblance to the symbol for the month *Tzec*, but varies in some important respects, as will be seen by comparison. The appendix, as I am inclined to believe, gives the *ah*, *ha*, or *hal* sound, and shows that it is a verb or word indicating action. As we find in each group the figure or symbol of a food animal, the whole series may be supposed to relate to feasts, or eating, or the collection of food. This suggestion is strengthened by the fact that the *kan* or maize symbol is placed in connection with the animal figures. It is possible, therefore, that this character may be correctly rendered by *tziclim* (*tziclimtah*), "to distribute, share, divide among many." As it is followed in each case by a cardinal-point symbol, and the symbol of the double tongued or toothed deity, probably Itzamna, is found in each group, it is probable that the text relates to religious festivals. This interpretation, however, is a mere suggestion or guess, which as yet I am unable to fortify by any other evidence than the resemblance of the main character to the *Tzec* symbol.



COPIES OF GLYPHS FROM THE CODICES

The Nahuatl, Tzental, and Quiche-Cakchiquel names of this day are the ordinary terms in these languages for "monkey." Dr Brinton thinks the Maya name, which does not appear to have any signification in this language as a separate word (though *chuenche* is "aborao, tuble," "a certain tree"), is derived from a Tzental term, *chiu*, which is applied to a particular species of monkey. He and Dr Seler refer to the *chouen* in a legend of the Popol Vuh, which undoubtedly stands in close relation to *batz* or "monkey," there spoken of as *hunbatz*. As these words in the Quiche myth appear unquestionably to refer to a species of the monkey tribe, or mythical persons under the symbolism of monkeys, the conclusion they reach is probably correct, and justifies the belief that the Maya name should be interpreted "monkey."

The origin of the symbol is uncertain, and Dr Seler makes no attempt to explain it. The difference between the simple form with the three teeth only (plate LXVI, 2) and the typical *Chuen* symbol indicates a difference in the word equivalents, or in the signification if ideographic. It is possible that Brasseur is right in rendering the former by *co*, which signifies "tooth;" in which case we may be justified in assuming that the additions in the *Chuen* symbol give the additional phonetic elements in the word. It may be, as supposed by some authors, that it was intended to represent the front view of an open mouth of some animal, as *chi* is the Maya word for mouth.

THE TWELFTH DAY

Maya, *eb;* Tzental, *euob;* Quiche-Cakchiquel, *e* or *ee;* Zapotec, *pija;* Nahuatl, *mallinalli* or *itlan.*

There are comparatively few variations in the symbol of this day; some, however, are of sufficient importance to render recognition doubtful but for their presence in the day series. That given by Landa is seen in plate LXVI, 4; the form most usual in the Tro. and Cort. codices is that shown in LXVI, 5; the variations seen in LXVI, 6, 7, 8, are from the Dresden Codex, and that in LXVI, 9, is from the Peresianus.

This character occurs very seldom, if ever, except as a day symbol, hence it is presumed to be purely ideographic or pictorial. There is, however, a deity symbol found in the Tro. Codex (plate LXVI, 10) in which we see apparently the chief characteristic of the *eb* symbol. Here, however, instead of a dot-bordered tooth, there is a dot-bordered dark stripe which runs downward entirely across the face. This is accompanied usually by the numeral prefix 11. The symbol of the same deity as found in the Dresden Codex is shown in plate LXVI, 11. Here the stripe is reduced to a single broken line. Dr Schellhas contends that he is a Death god and the equivalent of the Mexican Xipe. That he is a god of the underworld in the Tro. Codex is apparent from his ornaments and the dotted lines on his body or limbs; yet in two instances—plates 5 a and b—he is represented as a traveling merchant. Whether the deity in the Dresden Codex is the same as that of the Tro. Codex

is not positively certain, but the presence of the numeral 11 with the symbol, and in some instances the dotted lines on the body of the deity, indicate that the two are identical. Whether this deity glyph bears any relation to the day symbol is, however, doubtful. The only names of Maya deities I find with *buluc* ("eleven") as a prefix are Ahbuluc Balam and Buluc-Ahau (?). The first, which signifies "He of the Eleven Tigers," was one of the idols made at the festival of the new year Cauac. On one of the four plates of the Dresden Codex representing the festivals of the new year (26a) we observe that the image carried by the chac is a tiger-like animal marked with dotted lines. Whether this is to be connected with the deity above mentioned is doubtful. The other name, Buluc-Ahau, mentioned by Landa, is the name of one of the signs of the Katun given in his figure of the cycle, and, although he uses the word "idol," does not appear to refer to any particular deity.

In regard to the names of the first three calendars, Dr Seler remarks as follows:

> *E, ye* signifies "the edge," "sharpness," "the notch;" *eb, ebil, ebal, yebal,* "a row of notches," "flight of steps," "stairs." In Quiche-Cakchiquel *e* signifies "the tooth," "the edge;" *ee* is the plural form in Cakchiquel of the word, as *eeb* of the Quiche; *euob* is also a plural form in the Tzental, as I think, from a singular *eu-ee*. The name must denote the same thing in all the languages, i. e., "a row of teeth," "flight of steps"—a signification which harmonizes excellently with many Mexican forms of the character [plate LXVI, 12] as well as with the Meztitlan name of it (*itlan*, "his tooth").

Dr Brinton says that "in Maya *eb* is the plural of *e*, which means 'points' or 'ends,' like those of pins or thorns, and plainly was intended to designate the broom by reference to its numerous points. From the same idea, rows of teeth received the same name. The Tzental and Quiche names *e* and *euob*—the latter a plural—were from the same radical and had the same signification." He says the Nahuatl and Zapotec names both signify the brush or broom of twisted twigs, or stiff grass used for cleaning and dusting, and also this grass itself. Thus he brings the names of the five calendars into harmony. This explanation corresponds with that given by Clavigero of the Mexican term, which he says is the name of a certain plant of which brooms were made.

I am inclined to believe the symbol in this instance is a mere pictograph intended to represent the tip of some lanceolate leaf, the dots denoting the hairs along the edge. The tips of the "reed grass," as shown in the symbolic representation of *Zacatla* ("Nombres Geográficos" by Peñafiel; plate LXVI, 13), would give precisely the dot-bordered tooth in the symbol. It is to be observed, however, that the Mexican symbol for this day, the usual form of which is shown in LXVI, 14, is essentially different and has joined with the green blades the skeleton underjaw. In some instances, as at *Malinaltepec* ("Nombres Geográficos"), the entire skull is added. A more elaborate form of the symbol, from the Borgian Codex plate 26, is given in LXVI, 15. Here the skeleton jaw is

replaced by the roots of the plant; observe, however, the brush-like projections above. Are we to see in this associated death's-head a reference to death, or rather to the earth, a symbolism undoubtedly found in the Tro. Codex? Or must we suppose that behind the name is to be found the signification of the Meztitlan name *itlan*, from *tlantli*, "tooth?" Dr Seler remarks that "it seems to me quite possible that the point surrounded by dots in the character *eb* is an abbreviation of figure 326" (the prefix to our plate LXIV, 48).[1]

THE THIRTEENTH DAY

Maya, *ben* or *been*: Tzental, *ben*: Quiche-Cakchiquel, *ah*; Zapotec, *quii*, *ii*, or *laa*; Nahuatl, *acatl*.

The symbol of this day is subject to but few and, with one or two exceptions, but slight variations. Landa's figure is represented at LXVI, 16, those usual in the codices in LXVI, 17, 18, 19, and an irregular form found in Dres. 10c in symbol 20 of the same plate. When used in combination with other glyphs and otherwise than as a day symbol, the form, though usually typical, is subject occasionally to wide variations, though there is considerable doubt whether the latter are to be considered *ben* symbols.

Dr Seler contends that the figure originated from the plaited reed or mat, which, if correct, enables us to trace it by gradations to a wholly different figure. But before referring further to these, it is best that the signification of the names should be given as determined by linguistic evidence.

The Nahuatl name *acatl* signifies "reed," "cane," or "stalk;" and, according to Ximenes and Brasseur, the Quiche-Cakchiquel *ah* also signifies "reed," especially the "cornstalk" or "sugar cane." The Zapotec *quii* has also the same signification, "reed," and Dr Brinton says *laa* has the same meaning, but Dr Seler says he can not find it with this signification in the lexicons, nor do I find it in any to which I have access. The Maya and Tzental *ben*, however, presents a more serious difficulty in the attempt to bring it into harmony with the others. Dr Seler contents himself with reference to certain words which have *been* or *ben* as their root. This root, he says, signifies "consumed," and the words to which he refers mean "to be consumed," "to waste away," "to fail, be lacking, go away." This is also the signification to which Dr Brinton refers. "I find," he says, "that in Tzental the dried cornstalk (caña de mais seco) is called *cagh-ben*, and from this I doubt not this day-name in that dialect and the Maya was taken and syncopated. The verb *ben* or *been* in Tzental means 'to walk, to go,' but in the above compound the *ben* is from the Maya stem *benel*, 'to be used up, to be dead.'"

The opinion of Dr Seler, above stated, that the symbol of this day originated from the delineation of the plaited reed or mat, is based on

[1] Dr Brinton says it is the face of an old woman with a peculiar pointed earmark.

the representation of the mat both in symbols and figures in the Mexican and Maya codices. Some of these are shown in our plate LXVI, 21 to 24. The first, 21, is from the Mendoza Codex, and is found also in Tro. 20*d. These are undoubtedly intended to denote mats or something of a kindred nature. The same figure is seen on the roofs of temples and houses, one of which is shown in LXVI, 22, from Tro. 10*c. In these instances they appear to indicate the thatching with which the roof is covered. The form is sometimes varied, as in LXVI, 23, from Tro. 10*a. The symbol which, it is presumed, refers to the mat as seen in Tro. 21*d, is given in LXVI, 24; that representing the house in Tro. 10*c is seen in LXVI, 25; another of a slightly different form, from Tro. 7*e, in LXVI, 26; and another, referring also to a house or to the roof, as Dr Seler supposes, is given in LXVI, 27.

There can be no question that plate LXVI, 21, is intended to represent a mat or something of that nature, nor that the character shown at 24 is the symbol used to represent this mat, straw, or plaited fabric; nor can it be doubted that the figures shown at 22 and 23 are conventional figures for houses of some kind. It must also be admitted that the characters shown at 25, 26, and 27 are symbols denoting these houses. According to Dr Seler's interpretation, figures 24 and 27 are, in some cases, used "to denote a seat on a mat [24]; sometimes the mat roof of the temple or the temple itself" (27). In his opinion these characters, especially 27, contain "the element of the mat and a symbol of carrying—the hand or elements which have been borrowed from the figure of the hand—and in these hieroglyphs the transition of the realistically delineated mat into the character *ben* may be distinctly traced."

That the upper part of plate LXVI, 25 and 26, and of other similar figures in the codices which might be shown, do make a close approach in form to the *ben* symbol, must be admitted. But there is one break in the chain which needs to be closed before the evidence is entirely satisfactory. Does the upper part of these house symbols (25–26) indicate roof mats or thatching? An examination of the house figures shows these supposed mat figures to be something standing on the top of the roof—something rising, as it were, perpendicularly along and above the comb or crest. Now, precisely such battlements or elevated crests appear to have been common on the roofs of the temples or structures which have been preserved to modern times. We see them in the figures given by Charnay, Stevens, and other explorers; and what is worthy of special notice in this connection is, that they sometimes consist of openwork or trellis-like figures. Therefore, if we connect the upper part of the house symbols with the *ben* glyph, it is still by no means certain that it is derived from, or bears any relation to, the mat character. We notice further that in the figures of houses this supposed mat figure is not used to indicate the thatching, but is clearly distinguished from it. Again, if the upper characters of LXVI, 25, 26, are intended to signify the thatching, roof matting, or roof, and are simple ideograms drawn from

the thing represented, then the lower characters in these symbols might well be supposed to represent the wall or framework of the house. But the widely different relations in which we find this lower character forbid this conclusion. That the wall may be indicated is true, but if so it must be ikonomatically or by the phonetic value of the symbol. I have therefore found it very difficult to reach any entirely satisfactory conclusion in regard to these house symbols. That the lower character is phonetic in the true or rebus sense can, I think, be shown, but, notwithstanding the objections I have presented, the most satisfactory interpretation of the upper part is that it represents the roof, as we see in the upper figure of LXVI, 25, the crosshatching and the double *ben* lines. Hence it would seem satisfactory to consider it merely an ideogram or picture but for the prefix, which can not be readily accounted for on the idea of a pictorial representation.

As we have found that the lower character of plate LXVI. 26, has the phonetic value of *ch* usually combined with *o* or *u* (see remarks above on LXV, 44), we may find in this glyph *otoch*, "house," though the full signification of the entire compound symbol appears to embrace more than this. Possibly the upper part is a determinative. The lower part, however, of LXVI, 25 and 27, is found, as before remarked, where it can have no reference to a building. As it has the two heavy lines indicative of the *p* sound (see explanation of LXIV, 11), and also of the guttural, it is probable that the signification, where a structure is referred to, is *pak* (*pakal*), "a building, wall, fortification." But when it is found in an entirely different relation, as in Tro. 17b, where it is over an individual tying a deer, it must have an entirely different signification. It is possible that it may be consistently rendered by *pacoc* (*paccah*), "to cord, fasten, bind" (Henderson), or some derivative thereof. We find it again on Tro. 19*d and 20*d, and Dres. 18c, 1[illegible]e, and 20c, where females are represented as bearing burdens on their backs. Now, *cuch* signifies "to bear, to carry," and also "a load, a burden," and *cuch-pach*, "a carrier, a porter" (literally "to carry on the back," *pach* denoting "back").

In this instance also the phonetic value assigned it holds good. On Tro. 17b the same glyph stands above an individual who is in the act of striking a snake which is biting his foot. In this case it has a suffix like that to LXVI, 3, which, as we have stated, probably represents the sound *ah*, *ha*, or *hal*, and indicates that the word is a verb. There are several words containing the phonetic value assigned the character, which are applicable, as *pokchetah*, which Perez interprets "pisar, poner el pie sobre algo;" *puchah*, "despachurran, machucar;" *pachah*, "to scatter, break" (H.); *pech*, "to crush" (H.); *pacez* (*paczah*), "to squeeze, press, crush" (H.).

It seems, therefore, quite probable that the lower part of these compound symbols is phonetic.

If Dr Seler is correct in his supposition that the symbol is derived from the plaited mat, then it is most likely simply ideographic or a mere

conventional pictograph. Possibly this is the correct conclusion, as I can find no evidence tending to show that it is phonetic. If we could suppose the form was intended to represent a "road" or "pathway"—*be*, *beil*, and *bel* in Maya, and *beel* in Zotzil—we might assume it to be phonetic.

The combinations shown in plate LXVI, 28, 29, 30, and 55, in which the symbol of this day appears, have as yet received no satisfactory explanation. Those shown in LXVI, 28, and 55, are of very frequent occurrence and probably indicate some common ceremony, order, or direction in the religious ceremonies. I have a strong suspicion that the first indicates exorcism or driving away the evil spirits, but I find no appropriate Maya word unless it be *pekokalil*, given by Henderson. This, however, does not agree with the interpretation *Kinichkakmo*, given by Seler to LXVI, 29, above referred to. Seler gives to LXVI, 30, the apparently strained interpretation, "he who is conquered in war and brought home prisoner." I have no interpretation to offer.[1]

THE FOURTEENTH DAY

Maya, *ix* or *hix*; Tzental, *hix*; Quiche-Cakchiquel, *balam*, *yiz*, or *hix*; Zapotec, *che*; Nahuatl, *ocelotl*.

The symbol of this day is found in quite a number of different forms, some of which are wide variations from the prevailing type.

Landa's figure is shown in plate LXVI, 31. The usual forms found in the Tro. Codex are LXVI, 32 to 37; 36 is somewhat rare. That shown at 38 is found only on plate 30*c, and that showing the animal head (39) on plate 12c. No essential variations from these are found in either the Codex Peresianus or Cortesianus. Those shown in LXVI, 40–42, are from the Dresden Codex.

The Nahuatl name and the Quiche-Cakchiquel, *balam*, denote the "tiger," possibly the jaguar, though the Mexican name certainly refers to the *ocelot*. Dr Brinton says that the Zapotec *che*, or in the full form *be-eche-guia*, has the same signification. Dr Seler, however, derives it from the term *peche-tao*, "the great animal"—the tiger, or ferocious animal. But the other names, *ix*, *hix*, *hiix* or *gix*, as they are variously written (though really one word), present a more serious difficulty to the attempt to bring them into harmony with the others.

Dr Seler says:

> The Cakchiquel term *yiz*, i. e., the Maya *h-ez*, "the sorcerer," may well be considered as giving an explanation of the Maya name of this day character (*ix*). My conception, after one more link in the chain of evidence pointing toward it, is that the day-character system has become known to the Mayas through the medium of the cognate branches of Chiapas, for we frequently find the Tzental-Zotzil *x* corresponding to the Maya *z*.

[1] Brinton says the *ben* symbol looks to him "like a wooden bridge, the two supports of which are shown and which was sometimes covered with a straw mat." If so, it must be shown in profile, and the hanging marks above (see LXVI, 16, 17, 19) would seem to be without signification; moreover, in LXVI, 18, the supports hang from above, which would, on this theory, imply a hanging bridge.

Dr Brinton says that the Maya, Tzental, and Cakchiquel word *hix* or *ix* means "sorcerer," though he does not furnish the evidence. Moreover, he adds immediately after that "it is probable *ix* is a variant of *ik* or *igh* 'wind, breath, life,'" and makes the connection by referring to the fact that blowing was practiced in medicine rites. It would have been more satisfactory, however, had he given the evidence on which he based his assertion that the Maya and Tzental name means "sorcerer." According to Ximenes the Cakchiquel name *yiz* denotes the "sorcerer;" and it is probable that the signification of *ix* or *hix* is the same, as the codices appear to give support to this conclusion.

On Dres. 8a the character shown in plate LXVI, 43, stands in the text over the figure of a tiger, and evidently refers to it. The close resemblance of this to the *ix* symbol from Tro. 12c shown in LXVI, 39, is too manifest to be overlooked. The same symbol is found in Tro. 17c, but here the prefix is changed to the numeral 4; below is a tiger-like animal with a feathered tongue protruding from its mouth. I have taken for granted, from the indicated action and my interpretation of one of the accompanying symbols, that this figure was intended to indicate the sorcerer or diviner. This supposition I admit is not supported by sufficient evidence to demand acceptance. However, it is probable that Léon de Rosny is justified in rendering LXVI, 43, by *ek-balam*. This supposition will be strengthened by any evidence tending to show that the prefix is properly interpreted by *ek*.

The symbol for the month *Ceh*, as given in Dres. 49c, is shown in LXVI, 44, and is the same as Landa's figure minus the suffix or month determinative. It would seem from the fact that the lower character of this symbol is the same as the lower portion of the symbols for *Yax* (LXIV, 12) and *Zac* (LXVI, 48), that the word *Ceh*, if the writing is phonetic or ikonomatic, does not give the entire phonetic equivalent unless the *x* or *c* of the other names is here softened to *h*. It may be added, however, that Henderson gives both *Ceh* and *Kez* as the name of the month and the Maya name for "deer." In the Zotzil vocabulary "ciervo" is *chig* and "venado" *chigh*. There is, however, a difficulty in harmonizing this with the symbol for the month *Zip*—in which the same character appears—that I have not been able to explain. Nevertheless, it may be said, as the lower character appears (from evidence that will not be introduced at this point) to have *z* or *dz* as its chief phonetic element, that it is possible the name had sometimes *ek* or *ke* prefixed. Running through the lower division of plates 46–50 of the Dresden Codex is a line consisting of repetitions of the character shown in LXVI, 45. Here we have again our *k'*, *ke*, or *ek* glyph as a prefix. The right portion of the symbol bears a somewhat close resemblance to some forms of the symbol of the day *Lamat* (but not to *kin*, as has been suggested), and is so interpreted by Brasseur and Léon de Rosny. As *ek* signifies "star," and *lemba* "resplendent, bright, shining, sparkling," the phonetic value of the glyph may be "the bright, shining star," alluding to Venus. According to Henderson, *eekil*, *ekil*, or *yekil* was used to designate this star,

zaztal being added to name it as a "morning star." According to the "Report on the city of Valladolid,"[1] the name given the "morning star" was *noch eke* (or *eque*). It is possible, therefore, that Dr Förstemann is right in supposing that the long numeral series running through plates 46–50 of this codex relates to the apparent revolution of the planet Venus.

In Dres. 18c is the compound symbol shown in plate LXVI, 46, followed by 47. In the former we see our *ek* or *ke* symbol as the upper character and the supposed *cimi* (LXV, 28) glyph as the lower character, and to the left a prefix. This prefix is precisely that in the symbol for the month *Zac* (LXVI, 48), and has presumably the same value in one glyph as the other. This will give, as the proper rendering of the symbol LXVI, 46, *zeek-cimil*, "the skull of the dead." By referring to the figure below the text, a woman is seen bearing on her back a skull inclosed in a wrapping of some kind, which in Kingsborough, where the color is retained, appears to be cloth. This certainly agrees with the rendering of the glyph. The symbol which follows it, shown in LXVI, 47, has one of the elements of LXVI, 27, and, as suggested under "the Thirteenth Day," should probably be interpreted *cuchpach*, "a carrier or porter" (or "bear upon the back"). In the corresponding glyph in Tro. 20*d (LXVI, 24) the upper portion, as above stated, refers probably to the hamper or basket-like holder in which the load is carried, and is a simple ideogram; but here (LXVI, 47) the upper character is phonetic, corresponding very closely to the lower part of the symbols for the months *Yax* and *Zac*. The character which follows—the lower left-hand of the group of four—seen at LXVI, 49, is the well-known symbol for woman. As the women were the burden bearers in Yucatan, the interpretation appears to be consistent. It is therefore probable that the prefix to LXVI, 43, is to be interpreted by *ek*, as Rosny has suggested.

Seler, alluding to the symbol, asks, "May not the skin of the tiger, instead of the animal itself, be here indicated?" He further suggests that it represents the round hairy ear and the spotted skin of the tiger, and that the glyph shown at LXVI, 39, represents the entire head of this animal, of which there can be little doubt.

Some of the symbols of this day, found in the Fejervary Codex, one of which is shown in LXVIII, 41, appear to favor Seler's idea.[2]

THE FIFTEENTH DAY

Maya, *men*; Tzental, *tziquin*; Quiche-Cakchiquel, *tziquin*; Zapotec, *naa* or *ñaa*; Nahuatl, *quauhtli*.

Landa's figure is so imperfect in this case that it is not given. The usual forms and variations are shown in plate LXVI, 50 to 54. The last two, which show the widest variation, are from the Dresden Codex.

[1] Cong. Inter. Americanistes, 1881, tom. 2.

[2] Dr Brinton says the usual form suggests scattered grain husks, the word for which is *xiix*.

The Tzental and Quiche-Cakchiquel, *tziquin*, signifies "bird" in general, and the Nahuatl, *quauhtli*, "eagle." The Maya and Zapotec names are more difficult to bring into harmony with the others. Dr Brinton thinks that the Zapotec name is derived from *na*, "to know, to understand, to be able through knowledge." This, he says, "exactly corresponds to the Maya *men*, which means to understand, to be able to do . . . ; hence in this latter tongue, *ah-men* means the man of knowledge, the wise one, the master of wisdom." "The bird," he adds, "was the symbol of wisdom and knowledge."

Dr Seler says it is difficult to determine the Yucatan name. However, from the form of the symbol he concludes it is intended to represent an aged face, by which he connects it with an aged goddess, Ixchel, the companion of Itzamna, and with certain Mexican deities. In his subsequent paper he says the Zapotec name furnishes linguistic proof of the above conclusion. "I had concluded," he says, "that the Maya hieroglyph represented the image of the old earth mother, the universally worshipped goddess called Tonantzin, 'our mother,' who is connected in the Codex Vienensis with the eagle symbol." He then adds that the Zapotec term *naa* or *ñaa* signifies "mother," and thus finds the connection between the calendar names.

It is probable we will not be far wrong if we assume that reference to the bird as used in this connection is not so much to it as an animal as an augury, sign, or portent. The birds introduced in the Dresden and Troano codices, especially those on pages 16, 17, and 18 of the former and 18* and 19* of the latter, are supposed to have reference to auguries. In the "Vocabulario Castellano Zapoteco," under "Ave," we find *mani-biici*, "ave agorera." In the Dresden Codex (17b) one of the birds introduced as playing this rôle is an eagle, or some rapacious species resembling an eagle or vulture. Although Seler believes the symbol to have been derived from the aged wrinkled female face, yet he closes his observations on this day in his first article as follows:

> I think the reference to the eagle is very distinctly indicated [referring to a number of glyphs accompanying or indicating an eagle-like bird]. We can understand that these hieroglyphs were annexed as attributes of the deities. But how is it that figures 687–689 [same as our plate LXVIII, 42] serve as a seat for the Chac? Now Chac [he refers to the long-nose god] is not really a god of water, but of rain; the rain-producing storm cloud is his vehicle; the storm bird is his beast of burden on which he rides.

It follows from this, notwithstanding his supposition in regard to the origin of the symbol, that he looks upon it as signifying the eagle, or bird. However, the explanations given by Drs Brinton and Seler of the Maya name fail to make a satisfactory connection between the names in the different calendars.

Not only do we find birds introduced on the pages of the Troano and Dresden codices above referred to, apparently for the purpose of indicating augury, but on Dres. 69b we see the long-nose god (probably Itzamna) sitting on the glyph LXVIII, 42, holding a bird in his arms.

Also on Dres. 73b, where the groups are composed of short columns, each apparently relating to storms, winds, etc, we see in the right-hand group the bird and *men*-like glyph associated. Whether these are in fact *men* glyphs is a question not yet determined. I am as yet unable to interpret satisfactorily any of the compound characters of which these supposed *men* glyphs form a part. If the form shown in LXVI, 28, the lower portion of which is substantially the same as Landa's first *l*, is to be accepted as equivalent to LXVI, 55, then it is probable that the symbol of the day does not indicate the phonetic value of the name. This would lead to the supposition that the name *men* is not the original one applied to the day, or that the symbol has been changed. I am inclined to believe one or the other of these suppositions to be correct. If the symbol could be identified in the inscriptions, I would adopt the first supposition until substantial evidence of its erroneousness could be produced.

I am unable to offer any suggestions as to the origin of the symbol. I do not think the suggestion that it is intended to represent an aged face of woman or man of any force or worthy of serious consideration. The symbol would be just as complete so far as its signification is concerned without the eye as with it.

THE SIXTEENTH DAY

Maya, *cib;* Tzental, *chabin;* Quiche-Cakchiquel, *ahmak;* Zapotec, *guilloo* or *loo;* Nahuatl, *cozcaquauhtli.* In addition to these the following are also given: Pipil, *tecolotl;* Meztitlan, *teotl itonal* or *temetlatl.*

The forms of this symbol shown in plates LXVI, 56 to 59, and LXVII, 1 to 3, are those usually found in the codices, the slight differences being due to the greater or less degree of perfection with which they have been made. Landa's figure is similar to LXVII, 1. The variants in LXVII, 4 and 5, are from Dres. 46 and 49; but the symbols found in the day columns of Dres. 46 to 50 must not be taken as evidence of peculiar types, as they are to a large extent dashed off without care, one or two of a column being sufficiently exact for determination and the rest mere blotches. I have referred to them here and under other days simply because Dr Seler has noticed them; hence had I failed to allude to them it might be thought an oversight. However, I do not think any of the variations in the day columns of these five plates should be taken into consideration as types.

The Nahuatl name *cozcaquauhtli* is the "royal zopilote" (*Sarcoramphus papa* of ornithologists). Drs Seler and Brinton agree in the supposition that the Zapotec name is derived from *balloo*, "the raven or crow." Dr Seler says that the Quiche-Cakchiquel word *ahmak* seems to signify the vulture, "who peeks out the eyes," "who makes deep holes;" while Dr Brinton maintains that the Quiche *ahmak* means "the master of evil," referring to the owl, which is esteemed a bird of evil omen and bad fortune. The Pipil *tecolotl* also denotes "the night bird or owl."

COPIES OF GLYPHS FROM THE CODICES

The Maya and Tzental names, however, present a difficulty not so easily explained. The signification of the former is "wax, gum, or copal gum," and also, according to Henderson, "root." According to Brinton the Tzental radical *chab* means "honey, wax, bee, a late meal." He refers, however, to the Cakchiquel, where he finds that *ch'ab* means "mud, clay, mire," and suggests that "as red and black clays were the primitive pigments this may connect the Tzental day name with the Maya." Seler, however, derives the Maya name from *ci* or *cii*, "to taste good," "to smell good;" and as *ci* is also the name of the maguey plant, and likewise refers to the pulque or intoxicating drink from this plant, he concludes that *cib* must have been formed by the addition of the instrumental suffix, and hence refers to that which is used for wine, "either the honey, or, more correctly, the narcotic root."

This conclusion he thinks is strengthened by the fact that the corkscrew figure, which is the chief element of the *cib* symbol, is found several times on vases or earthen vessels (see LXVII, 6). Attention is called in this connection to the fact that *loo* in Zapotec signifies "root," which is also one of the meanings given by Henderson to the Maya *cib*, which would seem to strengthen Dr Seler's conclusion.

The glyph is seldom if ever found in combination with other characters or used otherwise than as a day symbol. This, together with the fact that it is not found except as a day symbol in the beekeeper's calendar in the Troano Codex, would seem to indicate that there has been a change in the name of the day since the origin of the symbol; or, on the other hand, the symbol has been modified from some older form. Nevertheless, there are some indications that it is phonetic and that the corkscrew figure has *b* as its chief element, whether *cib* be the word indicated or not.

In the symbol for the day *Caban* (LXVII, 9) we see the same corkscrew figure, and observe that *b* is the chief consonant element of the word. In the well-known symbol for woman (LXVI, 49) there appears the same character, usually double, one at the front of the face, the other on the back part of the head. I have usually considered this a mere conventional symbol, taken from the female head, these corkscrew figures indicating the rolls of hair. Nevertheless it is possible that it is phonetic, as we see on the cheek the *c*, *ch*, or *k* character heretofore referred to. As *chup*, *chupal*, and *chuplal* are names for "woman, female, or girl," the *p* may replace the *b* and represent the corkscrew figure. I am unable, however, to explain the prefix, which should have the *b* or *p* sound, or be a determinative. Possibly it may denote *pal*, signifying a young person, though this appears to refer generally to the male sex. Henderson, however, prefixes *x* to give it the signification "daughter, or girl."

That the symbol on vessels as shown in LXVII, 6, indicates liquid, or drink of some kind, is more than probable. It may refer to *balche* (or *baleze*), the ceremonial drink, the symbol indicating the phonetic element *b*.

The upper portion of the figure shown in LXVII, 7, from Tro. 3*b and 4*b (in the space) I was at first inclined to regard as a reptile of some kind, but the fact of its presence in the section relating to bees and honey, and the corkscrew markings, render it probable that it is beeswax. To this evidence may be added the fact that the symbol over which it is placed contains some of the elements of the *cib* glyph. There are a number of places where quite similar markings appear on seats and other things, but these are distinguished by the added line of dots, showing it, as will be seen hereafter, to be in these cases the *cab* or *caban* symbol.

The facts which have been mentioned, together with the form of the symbol, may possibly lead to a correct understanding of its origin. It seems probable that the corkscrew figure, which is the chief, and apparently only, essential element, is taken from the root of a plant and was the conventional method of representing that object. As it appears from Henderson's Lexicon that "root" was one signification of *cib* (probably from *cibah*, "to follow, succeed," which also signifies "born, manifested, root," alluding to origin), and also that in Zotzil *yib* or *yibel* is "root" (raiz de arbol, *yibel-te*), we find the reason why this was selected as the symbol to express the sound *cib*. The fact that in the Zapotec *loo* signifies "root" strengthens this conclusion and indicates that the symbol is not used simply for the sound indicated—that is, phonetically or ikonomatically—but also with reference to the signification.

THE SEVENTEENTH DAY

Maya, *caban;* Tzental, *chic;* Quiche-Cakchiquel, *noh;* Zapotec, *xoo;* Nahuatl, *ollin.* In addition to these, the following are also sometimes given: In Meztitlan, *nahui olli;* Pipil, *tecpila nahuatl.*

This character, as is apparent from plate LXVII, 8–13, is subject to no material variation; in fact, to no variation which would prevent us from at once identifying it. That shown in LXVII, 8, is Landa's figure. The change in position of the black spot and lines with reference to one another does not appear to have any significance. In the Troano and Cortesian codices the black dot is sometimes on one side and sometimes on the other. In the Dresden Codex, however, it is nearly always on the left. The one shown in LXVII, 13, in which there is introduced a new element, is found several times in the last part of the Dresden Codex.

This character is used very frequently otherwise than as a day symbol, being found separate and in combination, also as a mark on a number of articles. As it is possible to determine with reasonable, and in fact satisfactory, certainty its signification in a number of instances where used otherwise than as a day symbol, some of these will be noticed, as they seem to furnish strong evidence of phoneticism. But I repeat here the statement made at the commencement of this paper, that in using this term "phoneticism," I include that which

may, in a strict classification, be called ikonomatic. However, before referring to these, it is best to give the interpretations of the names which have been suggested, as the bearing of our interpretations of the symbols will then be better understood.

The Mexican name *ollin* or *olin* is generally interpreted "motion or movement," with special reference to the earthquake. Dr Seler, however, adds "caoutchouc ball." In his first paper, heretofore referred to, he remarks in regard to the Maya, Tzental, and Quiche-Cakchiquel names: "There is not much to be drawn from these words." In his subsequent paper he apparently relies upon the usual signification of the Mexican term, and from this and the signification of the Zapotec *xoo*, "powerful, strong, violent," concludes that the Tzental name may be consistently rendered by "large, powerful," and the Maya name by "that which is brought down, which is above," reference being made to ascending and descending. Dr Brinton derives the Maya term from *cab*, "might or strength," on the authority of the *Motul Dicc.*, and says that in this sense it corresponds precisely with the Tzental *chic* (equal Maya *chich*, "cosa fuerta y dura"), the Quiche-Cakchiquel *noh*, "strong, great," and the Zapotec *xoo*, "force, power, or might." Dr Seler, however, concludes that the Zapotec name is here to be interpreted "earth," or to be understood as referring to the earth. He thinks that the day symbol is an abbreviated form of, or derived from, LXVI, 49, which he takes to be a symbol of the goddess Chiribias or Ixchebelyax, whom he identifies with Zaczuy, "the white maiden." As will be observed, we have expressed the opinion that this glyph is a symbol for woman in the general sense, which conclusion appears to be confirmed by its connection with different female figures. There are, however, certain prefixes and suffixes which may serve to give it a specific application; for example, in LXVII, 14, from Dres. 16c, the prefix, according to my interpretation, contains the *z* sound as its chief phonetic element. It is possible that in this case a particular person may be referred to by the prefix, the woman symbol being here simply a determinative. Dr Brinton, in his explanation of the month name *Zip*, remarks: "This was *Zuhuy Zip*, the virgin *Zip*, her name being properly *Dzip*, 'to skin, to dress slain animals.'" I prefer, however, to interpret the symbol by "maiden," or "young woman," the prefix signifying *zuhuy*. Nevertheless, the suffix in some instances, as LXVII, 15, from Dres. 18b, may indicate that a sacred or mythological personage is referred to, as it is added as a suffix in some cases to deity symbols; however, as it is often found in other relations, where it can have no such signification, I am not inclined to give it this interpretation, as the evident female deities are denoted by quite different glyphs.

The evidence that the Caban symbol is in some sense phonetic appears to me to be too strong to be rejected. In the first place, one of its chief elements is the corkscrew figure, which, as shown under the preceding day, appears to have *b* as its consonant element, this sound

being a prominent element of both *cib* and *caban*. It also has been shown that it is not out of place in the woman glyph, under the supposition that this is also phonetic, as *chup* or *chupal* is the Maya name for woman, and the change from *b* to *p* is not uncommon. It is found in several places as that out of which plants are growing, as LXVII, 16, from Tro. 32b, which appears to represent some leguminous plant supported by a stake driven into the ground. It is that on which persons are sitting Indian fashion, and on which others are lying; again, it is that out of which a serpent is arising. As "earth," "ground," will furnish an entirely satisfactory explanation in all these cases, there is no apparent reason why it should not be accepted. As *cab* has "earth" as one of its leading significations, we not only find therein a connection with the day name, but also an indication of phoneticism.

In Cort. 30a is the figure shown at LXVII, 17. The animal represented, notwithstanding the quadruped head, is conceded to be intended for the serpent. The shading around the vessel, a blotch of which is on the serpent's nose, I take for the clay or paste out of which the vessel is being formed, or to be formed. In the division immediately below is a representation of what appears to be some step in the manufacture of vessels. May this not be correctly interpreted by *kancab*, "la terra roja o amarilla," or "red clay?" Henderson gives *cancan* as an equivalent term of *kankan*. As I have not seen a copy of the colored edition of this codex, I can not say whether this interpretation is borne out by the color of the shading. If this interpretation be correct, the serpent figure must be used symbolically or as a true rebus.

In Tro. 9*c an individual is represented lifting what is supposed to be honey or honeycomb out of a box-shape object on which is the *caban* symbol. This symbol is presumed to indicate the contents—"honey." If this supposition be correct, then, as *cab* is the Maya name for "honey," we have in this coincidence in sound and glyph another indication of phoneticism. Support is given to this interpretation by the fact that this is found in what is known as the "bee section," and that on the upper division of the same plate the same figure, with the *caban* symbol upon it, is seen in the hands of an individual who holds it to a bee.

As the character when used otherwise than a day symbol is frequently, perhaps most generally, drawn with a suffix, as shown in LXVII, 18, I suggest that it is possible it is a conventional method of representing earth or soil. By reference to the Borgian Codex, plate 11, also 19a and 61b, it will be seen that where earth is introduced into the picture it is indicated by heavy and wavy lines, as shown in LXVII, 19. This bears a very strong resemblance to the suffix of LXVII, 18. The corkscrew or root figure is added as appropriate, as an element, in forming an earth figure. Such, I am inclined to believe, is the origin of the symbol which, when used to indicate anything else than earth, is used phonetically or ikonomatically. The figure shown in LXVII, 20, from Dres. 30a, which Seler calls a serpent, is merely the representation of a clay image and

the seat or oratorio in which it is placed. It is probably from something of comparatively small size, burnt in one piece. The mark of the earth symbol, to distinguish the substance of which it is made, is certainly appropriate. In Tro. 6b we see another on which is quite a different symbol, indicating, as will hereafter be shown, that the material is wood.

The compound character in LXVII, 21, is found in Tro. 9*b and 10*e. It occurs in the latter twice, the parts, however, reversed in the parallel groups, while in that of 9*b one is above the other. These variants do not necessarily indicate a difference in the signification, as can readily be ascertained by comparing characters in the numerous parallel groups. Omitting the prefix, this may be rendered *mak-cab*, "to eat honey without chewing (that is, by sucking); to break into a hive and steal the honey." By reference to the plates on which the symbols are found the appropriateness of this rendering will be apparent, if I rightly interpret the figures below the text. There we see the twisted red symbols denoting the fire kindled beneath the hives, or beehouses, by which to drive out or destroy the busy little workers. In one of the fires we observe bone symbols, probably denoting a method of giving to the smoke an unpleasant odor, as rags were formerly used in some sections of our country for the same purpose.

The characters shown in LXVII, 22 and 23, are from the upper part of Cort. 22, which is supposed to be the right half of the so-called "title page" of the Tro. Codex. These are interpreted by Seler, and probably correctly, as indicating "above" and "below" (LXVII, 22, the former, and LXVII, 23, the latter). By following the line in which these characters are found, through the two pages, beginning at the left of the plate of the Tro. Codex, the result appears to be as follows, giving the signification of the characters so far as known: First, the four cardinal points in one direction, then two characters apparently corresponding with the two we have figured, one of which is partly obliterated; next the cardinal points in an opposite direction, after which follow the two characters shown in LXVII, 22 and 23. As the right half of the first (22) is the *cab* or *caban* symbol, it is presumable that it has here substantially the same phonetic value. It is probable, therefore, that the whole compound character may be rendered *yokcabil* (or *okcabil*), "above the earth," or as Henderson, who gives two words of this form, interprets the first, "over, above the earth, above." The second (LXVII, 23) has also as its chief part the *cab* symbol, and the upper right-hand portion appears to have *x'm* as its chief phonetic elements. It is possible that *cabnix* "a stair," "downward," given by Henderson, furnishes the phonetic equivalent of the compound character. These six directions, according to Dr J. W. Fewkes,[1] were noted by the Tusayan Indians in some of their religious ceremonies. Mr Cushing says the same thing is true in regard to some of the Zuñi ceremonies.

[1] Jour. Am. Eth. and Arch., II, p. 38.

Plate LXVII, 24, is a compound character from Dres. 39b, below which the long-nose deity holds in his hand a peculiar article (LXVII, 25), "as if," says Seler, "pouring out of a bottle." That the prefix has the interior cross-hatched when complete appears from a number of other places, as, for example, in the upper division of the same plate. This, as heretofore stated, gives the *x* or *ch* sound. It is possible, therefore, that the symbol, omitting the right portion, should be interpreted *xachcab*, "abrir de par en par," or *hechcab*, "to open little by little, to develop, discover it" (Henderson). As the right portion has a character resembling the *Muluc* symbol as its chief element, and below it the *u* glyph, we may translate it *muyal*, "cloud." This would give as the meaning of the entire symbol "open the cloud"—that is, "to pour out the rain." As this is connected with a rain series, and we see a similar glyph (though with different prefix) on plate 38b, where the same deity is in the midst of a rain storm and holding in his hand a similar objeet, the rendering appears to be, at least, appropriate. It is to be further observed that this combined *Caban* and *Muluc* symbol is found frequently in connection with rain storms and cloud symbols.

According to the interpretation given LXVII, 22 and 24, the compound symbol shown at 26, from Dres. 35b and 34b, should be rendered *Yokcabil muyal*, "the cloud above." As we see in both places, in the picture under the text, the looped serpent inclosing water, which Dr Seler considers the "water sack" or cloud, this interpretation is appropriate. As further confirmation of the interpretation given LXVII, 22, attention is called to the picture in Tro. 32*c over which the same symbol is found. Here the allusion is doubtless to the basket-like covering over, or "above," the black deity lying on a mat.

THE EIGHTEENTH DAY

Maya, *edznab* or *ezanab*; Tzental, *chinax*; Quiche-Cakchiquel, *tihax*; Zapotec, *gopaa*; Nahuatl, *tecpatl*.

The form of the symbol of this day varies but little in the codices, as shown by plate LXVII, 28–31. It is seldom found in this form in combination. If its equivalent is given in these, it is of the form shown in 33. It is, however, occasionally seen on articles of stone, as the spearpoint (32) and stone hatchet (34) and saerificial knife. It also appears in the symbol for the stone mortar (36) from Tro. 19c. Before discussing its signification and probable origin we will give the significations which have been suggested of the different names of the day.

The signification of the Nahuatl name—*tecpatl*—is "flint." Dr Brinton says, "especially the flint-stone knife used in sacrificing, to cut the victim." Dr Seler finds agreement in the Tzental name from a statement, by Nuñez de la Vega, that the symbol *chinax*, or rather the tutelary god of the same, was a great warrior, who was always represented in the calendars with a banner in his hand, and that he was slain and burned by the nagual of another heathen symbol. Dr Brinton states

that the name "is an old or sacred form of the usual *zni-nax*, 'knife.'" The literal meaning of the Cakchiquel *tihax* is, according to Ximenes, "it bites, scraping" (muerde rasgando). Dr Seler, however, affirms that Ximenes (with what authority he knows not) gives "obsidian" as the meaning. He thinks the word is related to the root *teuh*, "cold"—*tih-ih*, "to be cold"—with which may be compared the words *tic*, "to stick in, prick;" *tiz*, "to stitch," and *tiztic*, "pointed."

In regard to the Zapotec name, *gopa*, *gopaa*, or *opa*, the authors named differ quite widely, Dr Seler deriving it from *rogopa*, "cold," and Dr Brinton suggesting that it is more likely "a variant of *guipa*, a sharp point or edge, whence the word for stone knife, *gueza-guipa*, from *guia*, stone."

The Maya name, however, does not appear to be readily brought into harmony with the others. Dr Seler simply remarks that it may be related to the root *e*, "firm, rigid, hard." Pio Perez offers no explanation. Dr Brinton suggests that it is a figurative expression for the sacrificial knife, from *nab*, something anointed, or blood, and *edz*, to adjust, to point, to sharpen.

There can be no question that the articles in the codices on which the trembling cross is found consists, in most instances, if not all, of stone. Hence it is a reasonable conclusion that the primary signification of the symbol is stone. The Zotzil name for "flint" (pedernal) is *zuiton*.

I am inclined to believe that the symbol is derived from a conventional form used for indicating stone or flint, probably from the cracks or fissures in it.

I am not prepared yet to discuss the somewhat similar figures which assume the form of the St Anthony cross. Various interpretations, as symbol for "union," "night sun," etc, have been given. However, as this form is never used as a day symbol, it has no direct relation to the present discussion.

THE NINETEENTH DAY

Maya, *cauac;* Tzental, *cahogh;* Quiche-Cakchiquel, *caok, cook;* Zapotec, *ape, appe, aape;* Nahuatl, *quiahuitl.*

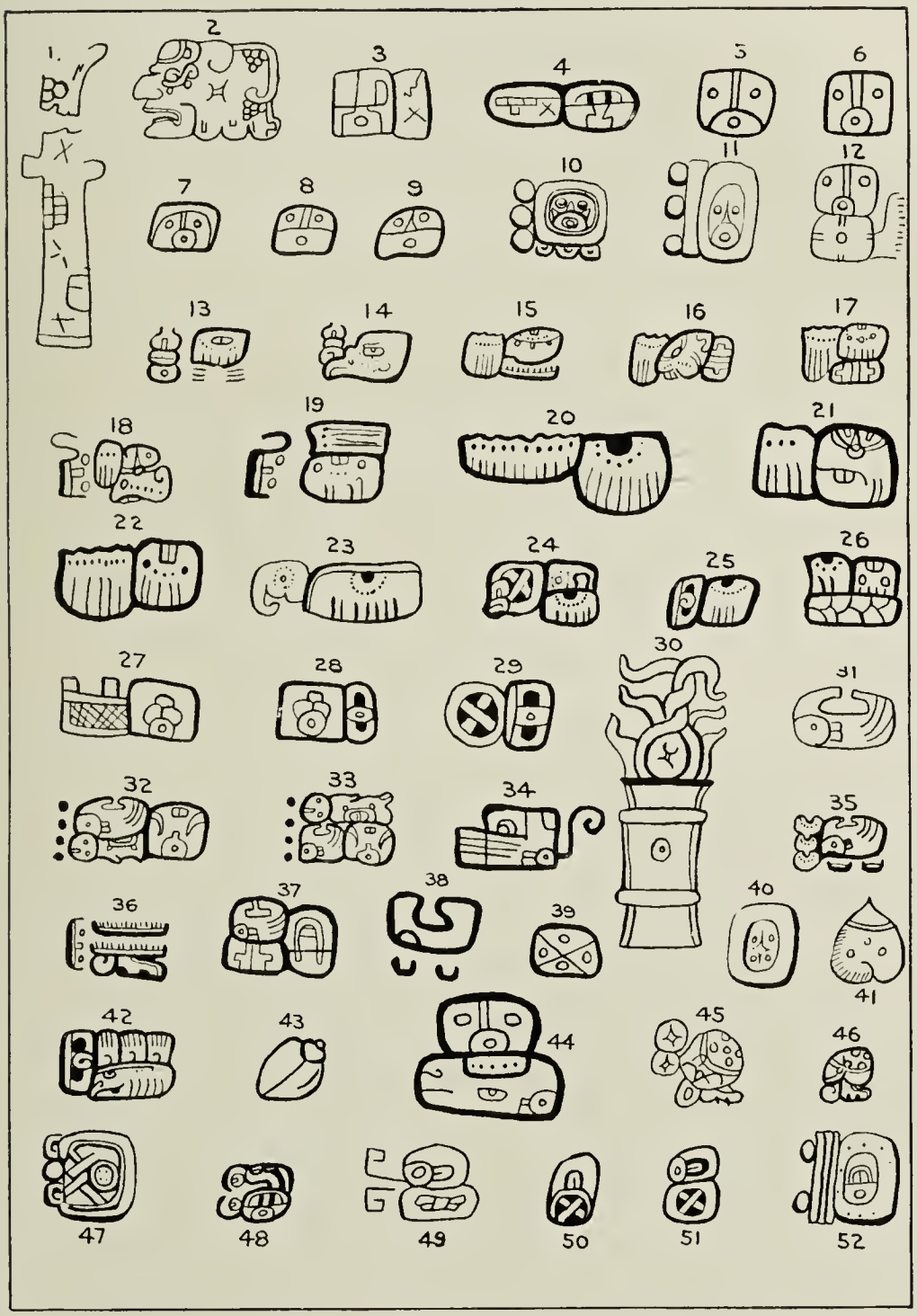
The various forms of the symbol of this day are shown in plate LXVII, 37–48—that by Landa at 37; those of the Troano and Cortesian codices at 38–43, and those from the Dresden Codex at 45–47. The irregular form given at 44 is from Tro. 28d, and that at 48 from the Peresianus.

This symbol is found quite frequently in combination with other characters, in some of which its phonetic value can be ascertained with reasonable certainty. For example, it forms the lower half of the symbol for the month *Yax*, as seen at LXIV, 12; also in the symbol for the month *Zac* (LXVI, 48). In both these instances its chief phonetic element appears to be the guttural sound *k*, or *ks*. The essential elements are also found frequently on objects which are undoubtedly of wood and where no reasonable explanation can be given except that it signifies "wood" in these places. For example, it is found on what appear to

be boards carried in the hands of individuals, on Tro. 32*b (LXVII, 49); and it also is seen on what appear to be wooden boxes or gums from which the honeycomb is being removed, as Tro. 5*c and 9*a. Dr Seler, who gives quite a different interpretation of the character from that presented here, admits that these are boards. It is also found on trees, as Tro. 15*a (shown in LXVIII, 1) and 17*a, and Dres. 26c, 27c, and 28c. It is marked on the walls of houses or canopied seats, as Tro. 6b, 29*c, and 18*b. Under the last mentioned we observe the *cab* symbol, showing that it is a building placed on the ground and not on a stone foundation. It also appears on the ends of beams, as at Tro. 9a and 22*a. True, Dr Seler contends that these are stones instead of weight poles, but I think all trappers will decide against him. Again, it appears on seats (Tro. 13a and 14*a) and also marked on heads, one of which is shown in LXVIII, 2. That the symbol is not intended to indicate the different articles on which it is found is evident; hence it must be given to denote the substance of which these things are formed, which I maintain can only be wood. That the trees and boards must be wood is admitted; that the walls of many of the houses and of some of the other buildings of Yucatan were of wood must be admitted; that seats were often of wood is well known. The heads with this mark are in all probability representations of wooden masks. Masks are represented in the hands of individuals at several places in the codices, as Dres. 42(1)a and in Peresianus. I therefore conclude that in all these cases the symbol is to be interpreted by *che*, *cheil*, "wood, tree, timber, stick."

In order to show the difference between the explanation given here and that by Dr Seler, I copy the latter:

> We find, for instance, on the one hand the undoubted application which is connected with the idea of cloud or rain. Thus, in the hieroglyph, figure 80, the accompanying hieroglyph of figure 46, i. e., the bird Moan. So also the one in figure 28 (p. 107) the accompanying hieroglyph of the name Kinchahan, which, besides canac, contains further the element of fire and that of the hatchet, which may remind us of the ray [or flash] darting from the cloud. The hieroglyph canac is, however, used far more commonly in the sense of "stone" or "heaviness." This is most clearly shown in the case of the animal figures pictured in Cod. Tro. 9a and 22*a, where the stone laid upon and weighing down the horizontal beam is represented by the element canac. But this explanation must be accepted also, because we find the pyramidal foundation of the temple covered with the element canac. And where, in Cod. Tro. 15*a, to the Chac who is felling a tree is opposed the death god, also felling a tree, covered by the element canac, it is clear that here there is substituted with the death god a rigid stone in place of what with the Chac is a sprouting tree. The numerous cases in which the hieroglyph canac serves as a seat or footstool of the gods are sometimes easily interpreted as signifying clouds, but in the majority of cases it undoubtedly represents "stone," homologous to the hieroglyph caban and the element *tun*, "stone," itself (figure 85), both of which are found equally often denoting the seat and footstool of the gods. It is equally evident that in the hieroglyph figure 84, in which there is indicated the bearing of a burden on the back, the element canac is to be understood simply as the expression of the weight, the burden. In the peculiar cases where we see the gods holding a board provided with the elements of the character canac, or where a board is placed before the gods, furnished with a plaited handle whose side bears the element canac, the latter seems to relate to a sounding board, for the accompanying hieroglyphs seem to signify music. Finally, there can be



COPIES OF GLYPHS FROM THE CODICES

found a direct homology between the element cauac and the element tun. This is seen in the hieroglyph of the hunting god of figure 83, whose distinguishing mark is usually an eye or the element tun (i. e., a precious stone), which he bears in the front of the headdress. The hieroglyph of this god is written sometimes as in figure 81, sometimes as figure 82. And that the element here, which in figure 82 replaces the element cauac, is to be understood in fact as tun or "stone, precious stone," is evident, on the one hand from the application of the precious stone in the headdress (tun, "piedra, piedra preciosa"), and, on the other hand, from its use as the base of the pole on which Mam, the Uayeyab demon, is set up during the xma kaba kin (Cod. Dres. 25c). Now, it is true that a connection of ideas can be established with considerable certainty between clouds, rain, and stone, for in that region every rain was a thunderstorm. But at the same time it will be found comprehensible that a barrier of doubt was removed when I discovered in the course of my Zapotec studies that in Zapotec the same word was used for "rain" and "stone," namely, *quia, quie.*

Aeeording to the explanation I have given above, the ehief phonetie element of the character is the guttural sound *k*, *ks* (or *x*), and *ch.* As additional evidenee tending to eonfirm this conclusion, the following examples are given:

Symbols 61, LXV, from Tro. 22*a, and 62, from Dres. 1 (42), have already been explained, the first as signifying *kutz* or *cutz*, "the turkey," and the seeond *tzac*, the name of a eertain fish found in the senotes. In the first (61) the first or left-hand character is our *Cauac* symbol and has the *k* sound, and the same symbol forms the right portion in the seeond (62) and also has the *k* sound. In LXVI, 47, from Dres. 18e, the *Cauac* symbol forms the first or upper portion. The whole eompound symbol, as above shown, may be consistently interpreted *cuchpach*, "a porter or carrier;" literally, "one who bears on the back." Again we see the *k* sound given the eharacter is consistent. The symbol for the month *Cch*, as found in the Dresden Codex, is shown at LXVI, 44. In this the last or lower portion is also the *Cauac* eharaeter, and, aeeording to the value assigned it, should have a harder sound than the simple aspirate. That such is the case is rendered probable by the faet that Henderson gives *cch* and *kez* both as names of the month and as Maya words for "deer." In the Zotzil *chigh* is the name for "deer." It is therefore apparent that the symbol has here the guttural sound.

The glyphs in LXVII, 50 and 51 (Cort. 21), probably signify "night" and "evening"; the first (50), *akab*, "night," and the seeond (51), *kankin*, one signifieation of whieh, aeeording to Henderson, is "evening." The wing-like appendage is probably a time determinative. These last interpretations are of course given with some doubt. However, this may be said in their favor, that wing-like appendages are usually attached to time symbols, and that the figures below the text represent persons, each of whom carries what appears to be a wheel, possibly like those used in keeping time, and the main character of the preceding symbol in both cases is the *Manik* glyph, having *ch* as its chief phonetic element and *chackinil*, signifying "hours, wheel." Preeisely the same symbol as LXVII, 51, preceded by the *Manik* glyph, and a wheel in the hand of the person figured below the text, is seen in Troano 35d.

The character shown in LXVII, 52, from Tro. 35c, may possibly be correctly rendered by *bakah* (*baakal*), "to roll round about, to go round about," alluding to the flight of the vulture figured below the text. This supposition appears to be strengthened by the probable interpretation of the symbol immediately below it (LXVII, 53), *malaalahah*, "without repeated buffetings." The character given in LXVIII, 3, from Tro. 31a, may be interpreted *pak*, "to sow seed, to plant," and that shown in LXVIII, 4, from the second division of the same plate, indicates the same word, as the transposition of the parts of a symbol does not always indicate a change of signification. Possibly, however, its equivalent may be *capak*, "to reseed or sow seed the second time," or *kapak*, "to place in a trench or hole." As the persons figured below the text appear to be planting seed by dibbling them in with a stick, this would seem to be an appropriate rendering. Dr Seler appears to have entirely misunderstood these figures, as he thinks they represent the deities pouring out water. I have in a previous part of this paper given some reasons for believing that these plates refer to the planting and cultivation of corn.

These examples will suffice at this point.

It is difficult to decide as to the origin of the glyph. However, I am inclined to believe it has grown out of a conventional symbol for wood, possibly drawn from the little knots and marks seen on the inside surface of split wood. This may be wide of the true explanation, but all the indications I can find point in this direction. As "wood" (*leña*) in Zotzil (I do not know what it is in Tzental) is *ci*—equal to *ki* or *qi*—we obtain the guttural sound which appears to be the chief element of the symbol. In its use it appears to shade off from the hard to the soft sound.

The Zapotec name *ape*, which, according to Dr Brinton, may properly be translated by "lightning," or "the lightning flash," is much like the name for "fire" which prevails throughout Oceanica. Commencing with the Malay *api*, we trace it through the Oceanic islands in such forms as *api*, *lap*, *yap*, *nap*, *yaf;* to New Zealand *kapura;* Tonga and Samoan *afi*, and Hawaiian *ahi*.

In the Zapotec words *laari-api-niza* and *ri-api-laha*, translated "relampage, relampaguear," we find precisely the original form of the Oceanic word for "fire."

THE TWENTIETH DAY

Maya, *ahau:* Tzental, *aghual;* Quiche-Cakchiquel, *hunahpu:* Zapotec, *lao* or *loo;* Nahuatl, *xochitl.*

The symbol for this day, except where evidently imperfectly drawn, is subject to but few and slight changes, that given by Landa corresponding to the form found in the codices.

The usual and correct form is shown in LXVIII, 5–7; slight variations are seen in LXVIII, 8 and 9. Dr Seler figures several other varieties, but

SHELL BEARING MAYA GLYPHS

This shell, on which are engraved seven Maya hieroglyphs, was found in Belize and courteously sent to the Bureau of American Ethnology by Sir Alfred Moloney, Governor of British Honduras The shell is here figured for the purpose of placing it before students of Central American paleography

as these are from plates of the Dresden Codex, where the symbol is in columns, where they are evidently hastily made, without any attempt to have more than one or two in a column complete, they are not given here. The character represented in LXVIII, 10, is from the Tikal inscription, and that in LXVIII, 11, from the Palenque Tablet.

The Maya and Tzental names signify "king, lord, sovereign." The derivation of the word has been explained in various ways. Brasseur explains it by "the lord of the collar," *ah-au*, as does Dr Brinton; Stoll gives "lord of the cultivated lands," from the Ixil, *avuan*, "to sow." Dr Seler, however, is disposed to derive the name from the masculine prefix *ah* and *uinic* or *vinak*, "man." His method of reaching this conclusion is as follows:

> For the Tzental word *aghual*, standing parallel with the Maya *ahau*, which doubtless corresponds to the abstract form *ahaual* of the word *ahau*, is to be referred rather to a primitive form *aru*, *a'ku*, *ahu*, than to *ahau*. In the Tzental Pater Noster which Pimental gives, we find the phrase "to us come Thy kingdom (Thy dominion)" expressed by the words *aca taluc te aguajuale*. The primitive meaning of *ahau* is certainly "man," "lord," and the two roots of similar significance, *ah* and *ru* (see *uinic*, *vinak*, "man") seem to concur in this word.

He explains the Quiche-Cakchiquel *hunahpu* by *hun*, "one," and *ahpu* "lord of the blowpipe," or "blowpipe shooter." Dr Brinton translates it the "One Master of Power." He brings the Mexican name into harmony by rendering it "the flower of the day"—that is, the sun; and the Zapotec by rendering it "eye," meaning "the eye of the day"—i. e., the sun.

When we attempt to bring the symbol of the day into harmony with the Maya name, we encounter a difficulty which can be overcome only by following a different line from that suggested by Dr Brinton or Dr Seler. That the character shown in LXVIII, 12, is the symbol for the cardinal point "east," which in Maya is *likin*, is now generally admitted, and that the lower portion is the symbol for *kin*, "day" or "sun," is also admitted. We are therefore justified in concluding that the upper portion, which is the *Ahau* symbol, stands for *li*, and that *l* is its consonant element. If Landa's second *l* (shown in LXVIII, 43) is turned part way round, it will be seen that it is a rough attempt to draw the *Ahau* symbol. If a careful study is made of his *l*'s as given in his list, and his example of spelling *le*, and of the similar characters in the codices, it will be seen that both his *l* characters are derived from the same original. For example, the character shown in LXV, 60, from Tro. 22*a is precisely the combination which this author translates *le*, "a snare," or "to snare." By referring to the plate it will be seen that it is followed by the character (LXV, 61) which we have interpreted *kutz*, "turkey," and that in the picture below the text there is a lassoed turkey. It is apparent, therefore, that both these forms are used sometimes for words of which *l* is the chief phonetic element, and that the parallelogram and two interior dots are the essential elements. The day symbol is of less frequency in combination than the other form, but it sometimes occurs. It must, however, be distinguished from the closely allied *p* symbol heretofore alluded to.

From what has been shown in regard to the symbol it would seem, if considered phonetic, that the original day name it was intended to represent contained *l* as its chief consonant element. If ikonomatic, the name of the thing indicated had *l* as its chief element.

I think there can be little doubt that the symbol, as has been suggested by others, was taken from the full face, the central double line representing the nose, the two open dots the eyes, and the circle below the mouth. Now, according to Fuller's Zapotec Vocabulary, the name for face is *lu*, which is the Zapotec name of the day. As has been stated, Dr Brinton thinks the Nahuatl and Zapotec names refer to the sun, and he is inclined also to believe that the "ruler" or "sovereign" referred to by the names of the Maya dialects is the sun.

I think we may rest assured that the symbol of this day was derived from the full face, and that the word (for face) it was intended to indicate had *l* as its chief phonetic element—possibly from *lec*, "brow, front, forehead." If derived from the face, its use as a day symbol, and in numerous combinations, proves beyond question that it is phonetic in the true or in the rebus sense.

APPENDIX

A LIST OF THE DEITIES OF THE DAYS OF THE MONTH IN THE MAORI CALENDAR (AFTER TAYLOR).

1. *Tane* was the parent of the tui, of birds in general, and trees.
2. *Ru*, the father of lakes and rivers.
3. *Rupe*, of the pigeon.
4. *Tangaroa*, of fish.
5. *Irawaru*, of dogs.
6. *Nga rangi-hore*, of stones.
7. *Manika*, of fire.
8. *Maui*, of the land.
9. *Mumuhanga*, of the Totara; also called Tukau moana.
10. *Paruri*, of the Tui [bird].
11. *Papa*, of the Kiwi [Apterix Australis].
12. *Owa*, of the dog; he was also the father of Irawaru.
13. *Pahiko*, of the Kaka.
14. *Punga Matua*, of the shark (tuatini), lizard, and tamuri [the snapper-fish].
15. *Tute maona*, of the Kahikatoa [a plant so named].
16. *Hina-moki*, of the rat.
17. *Tuwairore*, of the Kahikatea [a certain tree] and Rimu [a species of pine].
18. *Haere-awa-awa*, of the Weka [a large bird].
19. *Rongo*, of the Kumara [sweet potato]; also called Rongomatane.
20. *Tiki*, of man.
21. *Tute-nga-nahu*, of evil.
22. *Tahu*, of all good.
23. *Tawiri-matea*, of the winds.
24. *Mokoikuwaru*, of lizards.
25. *Otunai-rangi*, of the palm tree (nikau) and flax (harakeke).
26. *Haumia*, of the fern root.
27. *Tomairangi*, of dew.
28. *Haupapa*, of ice.
29. *Hauhunga*, of cold.
30. *Te-apu hau*, father of storm and tempests.

It must be understood that these are not the names of the days, but of the deities which preside over them, and of the things which they created or of which they had special care.

TUSAYAN SNAKE CEREMONIES

BY

JESSE WALTER FEWKES

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TUSAYAN SNAKE CEREMONIES

By Jesse Walter Fewkes

INTRODUCTORY NOTE

When I began my studies of the Snake dance at Walpi, in 1891, it was said by all the white men whom I consulted that this weird ceremony was confined to the pueblos of Walpi and Micoñinovi, and there was no mention in the literature dealing with the subject of its existence in other villages of Tusayan. During the course of my researches,[1] however, it was discovered that the same or a closely related ceremony takes place in even years at Oraibi and Cuñopavi, and considerable material was collected regarding the exhibition in the latter village in 1892. Shortly after the publication of my memoir[2] on the Snake ceremonials of Walpi, attention was called to the existence of a similar rite in Cipaulovi, so that we are now cognizant of its celebration in five Tusayan villages—Walpi, Micoñinovi, Cuñopavi, Cipaulovi, and Oraibi. As the remaining two pueblos, Sitcomovi and Hano, are now known not to have a Snake dance, we have exact information concerning the Tusayan villages where this ceremony is observed.

The ever-increasing interest in the Snake dance of the Hopi dates from the description by the late Captain J. G. Bourke in 1884. Since the publication of Bourke's valuable book, many articles of more or less scientific value have appeared, so that this rite has now come to be one of the best known of all aboriginal American ceremonials. Most of these accounts, however, deal with the Walpi presentation, and there is a wide field of research still uncultivated in the other pueblos.

The Snake dance at Micoñinovi was first described by Mr Cosmos Mindeleff,[3] and although it has been witnessed by many persons since his article appeared, the ceremony still remains one of the most obscure of all these presentations.

The first notice of the Snake dance at Oraibi we owe to Mr J. H. Politzer, of Phœnix, Arizona, who published numerous newspaper

[1] These studies were made in 1896, while the author was connected with the Bureau of American Ethnology.

[2] Journal of American Ethnology and Archæology, Vol. IV.

[3] Science, Vol. VII, June 4, 1886.

accounts of the 1894 presentation, which may be consulted in files of that date. In 1892 Mr R. H. Baxter observed parts of the Cipaulovi or Cuñopavi dances and published a short notice of them in the *American Antiquarian*. It can hardly be said, however, that the accounts by Politzer and Baxter advanced our knowledge of the Snake dance to any considerable degree, as the secret ceremonials were wholly neglected and the public events superficially, often inaccurately, described. They have a value, however, in verifying the statements which had already been made after personal observation of the dances in these three pueblos. Mr Politzer's photographs showed an unexpected fact, that the numbers of participants in the Oraibi dance were small, a feature on which I have elsewhere commented.

From reasons which need not be enumerated, the majority of the descriptions of the Tusayan Snake dance have been limited to the exhibition at Walpi, and our knowledge of this variant far exceeds that of the other pueblos. It is, therefore, but natural that the Walpi dance should be regarded as the most complicated, and while extended research tends to support such a conclusion, it does not necessarily demonstrate that the ceremony at Walpi is the most primitive, but rather tends to show the reverse. To obtain what light we can on this point, as a preliminary to generalizations in regard to the nature and meaning of the Tusayan Snake dance, it is desirable to investigate the details of the presentation in the villages where our knowledge is more fragmentary. The present article is, therefore, offered as a contribution to a study of the Snake dances of Oraibi, Cipaulovi, and Cuñopavi, with generalizations which, it is believed, are warranted by new data obtained from these observations.

The duration of the Snake dance ceremonial at Walpi, where it is celebrated in the most elaborated form, may be stated as twenty days, of which only nine days are marked by active ceremonials, secret or open. Sixteen days before the Snake dance occurs it is formally announced, and on the preceding night the chiefs gather, engage in ceremonial smoking, and commission the town crier to call out the date on the following sunrise.[1] The next seven days are not days of ceremony, although the Antelope chief is engaged in preparations. The eighth day (on which he and others enter the kiva, or "*pakit*," as it is called) is the *yüñya*, or assembly, and for nine days the secret ceremonials continue, closing at sunset of the ninth day by a dance in the plaza, when snakes are carried in the mouths of the participants. The following four days are included in my enumeration, as they are days of purification, but are conspicuous to public eyes only as the frolics, called *nüütiwa*, which I have described elsewhere. If these different components are rightly embraced by me in the Snake ceremony, we have, in the twenty days' proceedings, five groups of four days each;

[1] The "Oraibi Flute Altar," Journ. Amer. Folk-lore, Vol. VIII, No. XXXI.

or, beginning with the last, four days of frolic, four days from the erection of the Snake altar to the Snake dance, four days from the erection of the Antelope altar to the making of the Snake altar, and eight inactive days, which I am unable to separate by any distinct events.

The nine days of ceremony, beginning with *yüñya* and ending with the dance, have a nomenclature suggestive of a division into two groups of four each. The day after the assembly is called the "first day" (*cüctala*). Then follow the "second day" (*lüctala*), the "third day" (*paictala*), and the "fourth day" (*naluctala*). The second series then begins with a second *cüctala*, or "first day," closing with the public dance.[1] On this basis it will be seen that the number four, so constant in pueblo ritual, is prominent in the number of days in the Snake ceremonial. I will call attention also to the fact that the nine days of ceremonies plus the four days of frolic make the mystic number thirteen. It may likewise be borne in mind that the period of twenty days, the theoretical length of the most elaborate Tusayan ceremony, was also characteristic of other more cultured peoples in Mexico, and that thirteen ceremonials, each twenty days long, make a year of 260 days, a ceremonial epoch of the Maya and related peoples.

The comparative studies which are here considered deal with portions only of the rites of the nine days. This has been necessary on account of the poverty of data at my control. There seems abundant evidence that in the three pueblos considered there is no such complexity of secret rites as at Walpi, and consequently there are abbreviations. Thus the Antelope altar at Oraibi is not erected on *yüñya*, as at Walpi, while at Cipaulovi it is made on the second *cüctala*, or only four days before the dance. When we know all the details of the Snake ceremonials in each of the five Tusayan pueblos, we shall be able to draw our comparisons much more closely than at present. This article, therefore, is preliminary, a temporary summary, or a step, it is hoped, toward a more exact knowledge of the Snake dances in all the pueblos of Tusayan.

The dates of the nine days on which ceremonials belonging to the Snake dances were observed in 1896, at the three villages, are as follows (the presence of the author is indicated by an asterisk):

	Oraibi	Cipaulovi	Cuñopavi
Yüñya	August 11	August 15*	August 16
Cüctala	August 12	August 16	August 17
Lüctala	August 13	August 17	August 18
Paictala	August 14	August 18	August 19
Naluctala	August 15	August 19	August 20
Cüctala	August 16	August 20	August 21
Komoktotokya	August 17*	August 21*	August 22
Totokya	August 18*	August 22*	August 23
Tihüne	August 19*	August 23*	August 24*

[1] Journ. Amer. Eth. and Archæol., Vol. IV, pp. 13, 14, note.

The secret rites at Cipaulovi took place in the two kivas, the one at the right as one enters the pueblo from Micoñinovi being occupied by the Antelope priests, that on the western side being used by the Snake priests. The Antelope kiva was the same as that occupied by the *Katcina* chief in the *Nimánkatcina*, as I have elsewhere described.[1] The two kivas used at Cuñopavi are at the entrance of the pueblo, that to the left being occupied by the Antelope priests, the one to the right by the Snake priests. The two Oraibi kivas occupied in the Snake dance were on the western side, the one to the right as one emerges from the village being used by the Antelopes, that on the left by the Snake priests.

[1] Journ. Amer. Eth. and Archæol., Vol. II, No. I, pp. 99–103.

THE CIPAULOVI SNAKE CEREMONY

General Remarks

It has elsewhere been shown that the Snake dance is announced sixteen days before its celebration, after a formal smoke by the chiefs on the preceding night. The nine days of active ceremonials are composed of seven days of secret observances and two of public exhibitions in which dances in the plaza occur. One of these takes place on the eighth day, and has been called the Antelope;[1] the other, on the ninth, is known as the Snake dance proper. The nomenclature of these nine days at Walpi has likewise been given, and the same holds in regard to the days of Snake ceremonials at Cipaulovi, Cuñopavi, and Oraibi. On August 16, the *cüctala*, or first day at Cipaulovi, I visited both Antelope and Snake kivas of this pueblo, but found no altar there. This was exceptional, as compared with Walpi, at the very outset, for in this pueblo the altar is made on the assembly day (*yüñya*). The Antelope chief was present in the kiva, and a bundle of sticks was noticed at the rear end of the room, leaning against the wall. These sticks were the crooks which were later set about the altar in a way which will be described. The chief said the altar would not be made for four days—a statement which I afterward verified—and he added that the Snake dance would occur in eight days. While I was talking with the Antelope chief, the Snake chief came in, and smoked in a formal way; and at the close of the smoke the Antelope chief gave him three strings with red stained feathers tied at their ends (known as *nakwákwocis*), and a small white feather. When the Snake chief received them, he sprinkled a little sacred meal on the bundle of sticks and returned to his own kiva.

So far as I could judge, this ceremony corresponded to the delivery of the prayer-sticks (*pahos*) to Kopeli, the Snake chief, when he went on the snake hunt which I have elsewhere described at length,[2] for the Snake priests immediately set forth on a snake hunt northward from the pueblo. For the next four days this simple ceremony of delivery of the feathered strings to the Snake chief was repeated, and the Snake priests hunted reptiles in the remaining world-quarters, west, south, and east, in the prescribed circuit.

[1] The "Oraibi Flute Altar" (see the Bibliography at the close of the article). Strictly speaking, this dance should be called the Corn dance; but as the corn-growing element of the Snake ceremonial is limited to the Antelope priesthood, I retain the name Antelope dance for the public exhibition on the eighth day.

[2] Journ. Amer. Eth. and Archæol., Vol. IV, pp. 40, 41.

There was a small *natci*, made of two sticks tied together, set in the straw matting of each kiva, as at Walpi, and the snake whips of the Snake kiva were arranged upright in a row leaning against the rear wall. This row of snake whips was the only feature comparable with an altar that was constructed in the Snake chamber of Cipaulovi.

As I was obliged to spend the following days at Micoñinovi, studying the Flute observance, no further visits were made to the Cipaulovi kivas until August 21, or the day called *komoktotokya*, when I saw the Antelope altar for the first time, it having been made apparently either that morning or the day before.[1] The Antelope chief, Lomatowa, was absent at the time of my visit, and did not return for several hours, during which I made several visits to the Snake kiva, returning now and then to see the chief when he came back.

The Antelope Altar

The altar of the Antelope priesthood at Cipaulovi (plate LXXI) was the simplest yet reported in any Antelope kiva, but in form and design was closely allied to that at Walpi. The sand picture was large, measuring 4 by 3½ feet, that at Walpi being only about 32 inches square. The kiva was relatively so small, or the sand picture so near the middle of the floor, that one could see it from outside the room by looking through the hatchway. The border, like that of the Walpi altar, was composed of four bands of sand, colored yellow, green, red, and white, respectively, separated by black lines, as in the Antelope sand picture at Walpi. This border inclosed a rectangular field on which were depicted, in different colored sands, the semicircular raincloud; four yellow, adjacent to the border; three whole and two half semicircles of green; four red, and three whole and two half semicircles in white. All of these were outlined with black lines. On the remaining part of the inclosed rectangle, which was covered with white sand, there were four zigzag figures with triangular heads, one yellow, one green, one red, and one white, beginning at the left of the sand picture as one approached it from the ladder. Each of these figures had a single black mark on the neck representing a necklace, and a curved horn on the left side of the head, and was outlined in black. In the existence of horns on these zigzag figures they differ from the sand picture at Walpi, where two have horns and the other two squares, the former representing males and the latter females. The black dots for eyes were seen in all these symbols of lightning, but the small *nakwákwoci* were not put on their necks, and the annulets and cylinders were not observed on the side of the head, as at Walpi. The row of parallel black lines from the semicircles, representing falling rain, were shorter and more numerous than on the Walpi altar.

At each angle of the sand picture there were conical bodies a few inches high, probably of clay, painted yellow, green, red, and white,

[1] *Cüctala*, or "first day" of the second series. It will thus be seen that with the exception of the four snake hunts serious rites were abbreviated in the Antelope kiva.

The pahoki or shrine in the plaza

The kisi

THE SNAKE DANCE AT CIPAULOVI

corresponding with the colors of the cardinal points.[1] At the apices were small feathers.

There were no stone implements on the outer border of the sand picture, as at Walpi, but their places on each side were occupied by a row of clay pedestals, twelve in number on each side, those in each series being placed close together. Each clay pedestal had a straight stick with cornhusk, feather, and string tied to the end. There were none of these sticks at the front of the sand picture, and most of them were not curved at the ends. There were no stone fetishes along the rear of the sand picture, nor stone implements or sticks in pedestals on that side. The *tiponi* was placed back of the extreme right-hand corner, and was separated by a considerable space from the sand picture. Back of the rear edge of the picture, at the right of the median line, there was a small vase and two snake whips standing upright. The floor in front of the picture had about fifteen basket trays, each containing the *pahos* made by individual Antelope priests, and in their midst was the medicine-bowl.

It will be seen that the main points of difference between this altar and that at Walpi are the absence of stone implements, fetishes, and sticks on the front and rear of the picture. The situation of the *tiponi* is different, and there are minor variations in the heads of the lightning symbols and in the arrangement of the sticks and other accessories. The Antelope chief bewailed that his altar was so poor in *wimi* (fetishes), and showed me, in addition to what have been mentioned, a trochid shell and a few rounded stones. I could add to his paraphernalia only a small quartz crystal, which, however, he greatly prized.

The Snake chief at Cipaulovi has no *tiponi*, and consequently no altar. The only objects at the end of the kiva, where the altar would have been had he possessed a *tiponi*, was a row of twenty snake whips leaning against the ledge of the rear wall, behind the *sipapû*. There were two large bags hanging from a peg in the rear wall of the kiva, and on the floor, at one side, four canteens like those which the women use to carry water from the spring to the pueblo. These were full of snakes, and their apertures were stopped with corncobs. The head of an arrowsnake protruded from one of the bags hanging on the wall.

The Ceremonies on the Day called Totokya[2]

On August 22, which was the day before the Snake dance at Cipaulovi, I visited both the Antelope and the Snake kiva at about 9 oclock a. m. Both kivas displayed a bow tied across the ladder, about 6 feet above the hatch. These bows had red-stained horsehair hanging to the strings, and a few large feathers suspended at intervals. On the roof, about the hatchway, radiating from the entrance, were six lines

[1] The Walpi *Lalakonti* altar has four meal cones in the same positions. American Anthropologist, April, 1892, p. 116, pl. I, fig. 3.

[2] The eighth day of all great ceremonials is called *totokya*.

of meal on a layer of valley sand, which had been evenly sprinkled on the roof of the kiva. When I entered the Antelope kiva, I found eleven priests assembled there, all engaged in making *pahos* and all with red feathers in their hair. Traces of meal, which had been sprinkled by the priests, were seen on the colored sands of the altar; this was probably an evidence that songs had been sung about it the night before, as I was told had been the case, but was not present.

All the *pahos*, with certain exceptions to be noted, were of the length of the middle finger, and were painted green, with red points. Each *paho* was composed of two sticks, one of which, called the female, had a facet at one end. These *pahos* were tied midway of their length, and to them were attached two herbs, called *kurnyû* and *máabe*. When I called the attention of the priests to the fact that at Walpi *pamnabi* was used instead of *máabe*, they replied that both were equally efficacious, and had the same intent. In addition to the green *pahos*, others, painted black, were similarly employed. The pipe-lighter, who, while not the chief, was most communicative, explained the signification of the offerings he made. They were as follows:

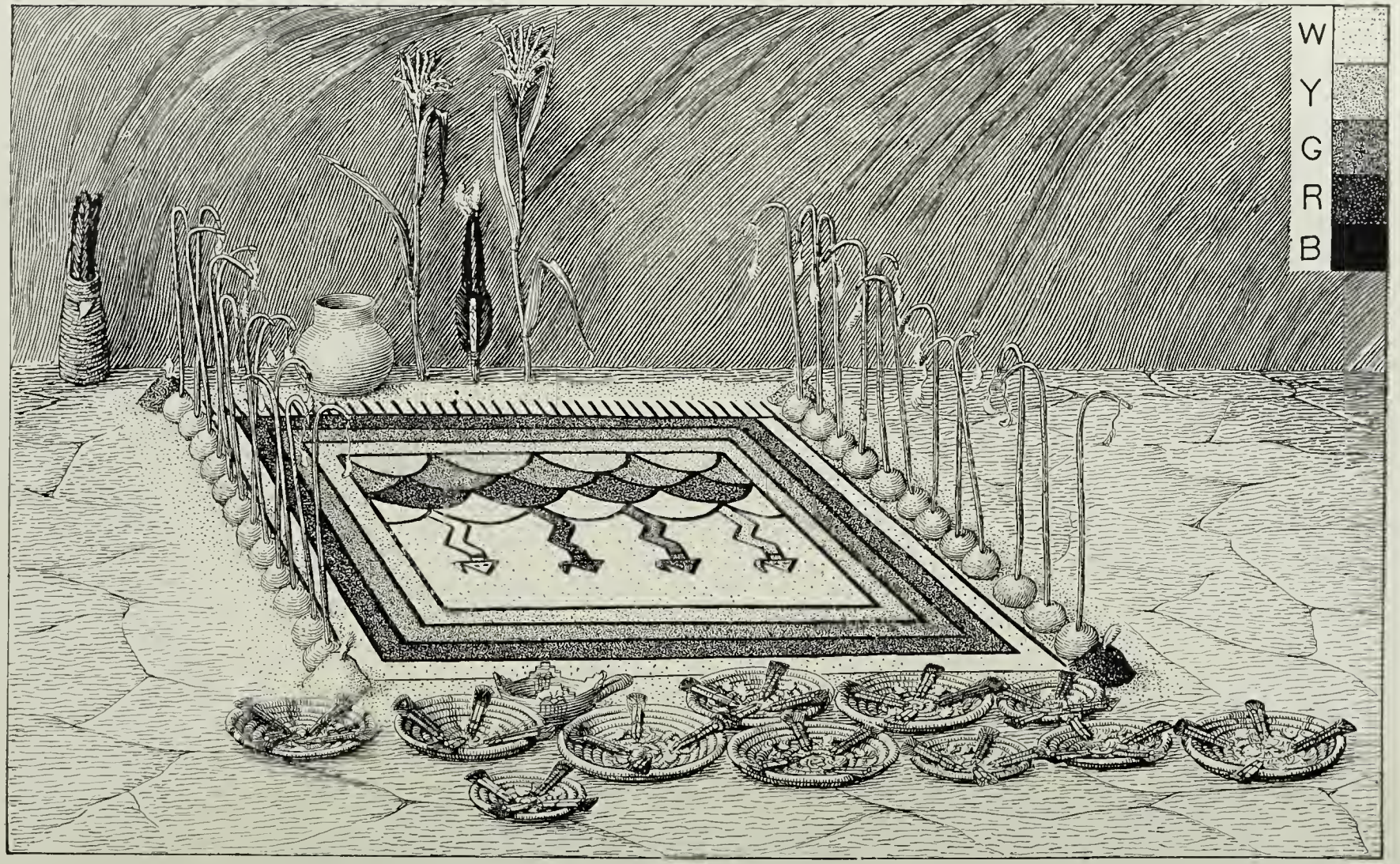
1. A black *paho*.
2. A double-stick green *paho* or *cakwapaho*, with six attached *nakwákwoci*.
3. A green *paho* with green points.
4. A green *paho* with black points.
5. Five white-feathered *nakwákwocis*.

It will be noted that the green *pahos* were of the length of the middle finger, which is very different from the plumed sticks made by the Antelopes at Walpi on the day before the Snake dance, for on that day the Walpians make a *paho* the length of the last two joints of the same finger. On interrogating the priests, I discovered that the Walpi rule was not carried out in Cipaulovi, and that there was no variation in the length of the *paho*.

We have seen how tardy the chief was in making the Antelope altar, and consequently it is apparent why the seven *pahos* of different lengths could not be made, for the sixteen-song celebration was curtailed in the number of presentations, and its equivalent performed only once or twice.

About noon there were brought into the kiva stalks of corn and vines of the bean, cantaloupe, watermelon, and of certain unknown plants. These were done up with yucca thread in two wads or bundles and placed on the altar, after which the man who tied them together smoked on them for some time and then placed the bundles back of the altar. These bundles were carried in the mouth of the participant in the Antelope dance, which, in Cipaulovi as at the other pueblos, occurred at sunset of this day (*totokya*).

At the close of the *paho* making, at about 1.30 p. m., a young man was given a *paho*, the netted gourd, and an ear of corn. He donned a



ALTAR OF THE ANTELOPE PRIESTS AT CIPAULOVI

ceremonial blanket, and was commissioned to deposit the *paho* in a spring. As no songs were sung, and as he bore an ear of corn and a single *paho*, one would naturally have regarded this youth as a novice, but such was not the interpretation given me by the assembly. When the youth returned, he carried spring water in the netted gourd, and still held the ear of corn. The chief took these from him and laid the netted gourd on a little pile of sacred meal near the altar. On the corn, which he deposited near by, he sprinkled sacred meal. The chief then took the pipe, lighted by the pipe-lighter, and smoked several puffs into the water, kneeling on the floor before it. He then handed the pipe to the young courier, who squatted at his side and smoked in turn.

While this was going on, another young man, who had brought into the kiva a number of willow sticks as thick as a lead pencil and perhaps two feet long, began cutting them into small sections, allowing them to fall into a basket tray. After having made these sections, he moistened them and carried the basket out of the room, placing it on the roof of the kiva, so that the moistened twigs might dry in the sun. Later, several balls of clay, about the size of baseballs, were made and placed in the same basket. These are the objects called the "frog's young," which I have described in my accounts of the Snake and Flute ceremonials at Walpi. The Antelope chief then took a flag leaf, moistened it, and made an annulet, rolling the leaf back and forth, in and out, and when finished he tied to it two small feathers. In all respects this annulet was like that carried by the Flute girls in the Flute ceremony or placed on the heads of the female lightning figures on the sand picture of the Antelope altar at Walpi. It was painted black, and one of the netted gourds was placed upon it by the side of the altar.

By this time, or about 2 oclock, all the Antelope priests had finished making their *pahos*, and laid them down, each depositing his prayer-sticks in his own basket tray, in front of the altar, as shown in plate LXXI.

The chief carefully swept the floor of the kiva, gathering up all shavings, whittlings, and fragments of herbs. This refuse was placed in a blanket, sprinkled with meal, and carried out. Shortly afterward a priest brought in all the Antelope rattles and deposited them in the corner of the kiva; all these objects are in his keeping, but each priest brought to the room all his other paraphernalia.

The Antelope Dance

The Antelope dance at Cipaulovi took place in the larger plaza at 6.20 p. m. on August 22. A *kisi* was erected on the southern part of this open space, about halfway between the central *pahoki*, or shrine, and the arcades through which the priests came from their kivas. A plank, with a hole in it symbolizing the *sipapu*, was let into the ground

immediately before the *kisi*, the entrance to which was closed with a blanket (?) or cloth.

Eleven Antelope and thirteen Snake priests took part in the Antelope dance, and at Cipaulovi, as at Walpi, the whole afternoon was consumed by them in their kivas, costuming for the public exhibition. Shortly before the priests emerged from their rooms, the Antelope chief went over to the Snake kiva, and, without ceremony, asked the Snake chief if he were ready. This was in marked contrast to the formal invitation presented at Walpi, where the Antelope priests sprinkle pinches of sacred meal in the hatchway of the Snake kiva and form a line before it.

Shortly after the return of the Antelope chief to his kiva, the eleven Antelope priests filed out of their secret room, led by their chief. They wore practically the same costume as the Antelopes of Walpi, which seems to be prescribed in all the villages.

The chief carried his *tiponi* across his left arm, and bore in one hand the bow with red horsehair attached to the string. Next to him was a man with the netted gourd, an ear of corn, and a *paho*. There was a third, who later took a position midway in the line and carried a well-filled medicine bowl. Each Antelope wore a ceremonial kilt of white cotton with embroidered ends, ornamented with raincloud symbols in red and dark green. Their faces had a line of white from the corners of the mouth to the ears, and the chin was painted black. They had zigzag lines of white on the breast, arms, and legs; fox-skins depended from their waists behind, turtle-shells were fastened back of the knee, and each was richly ornamented with shell and turquois necklaces. Every Antelope except the chief and the bearer of the medicine bowl carried two rattles. A few of the participants wore cottonwood leaves in their armlets.

The procession, headed by their chief, filed four times around the plaza, the circuit being sinistral, or with the center on the left hand, but not including the *pahoki*. As the Antelopes passed the shrine they threw a pinch of meal toward it, and as they approached the *kisi* each man dropped a pinch of sacred meal on the plank, and stamped violently upon it. At the end of the fourth circuit they formed a platoon, separated into two sections by the *kisi*, the chief standing at the extreme right. They continued shaking their rattles, but not singing, while the Snake priests made their entrance. No *kalektaka*, with a whizzer, followed the Antelope priests.

The Snake priests, headed by their chief, came shortly afterward. Their chief carried his bow with red horsehair, but had no *tiponi* or other official insignia. The Snake priests followed him, and the line made four circuits of the plaza, embracing the whole rectangle in their course. As they passed the shrine they dropped a pinch of meal upon it, and when in front of the cottonwood bower they did the same, stamping violently on the plank in the ground.

As a rule the Snake priests were appareled similarly to those of Walpi, but the whole face was painted black, with white under the chin and on the neck. Their cheeks were not smeared with the micaceous hematite which gives such a hideous appearance to the Walpi performers.

After the thirteen Snake men had lined up before the eleven Antelopes, who all the time were shaking their rattles, a low song began, the Antelopes being the singers. As the song progressed the Snake men locked arms and stepped backward and forward, while two men, an Antelope and a Snake, ambled backward and forward between the lines of swaying priests. They went to the *kisi* or cottonwood bower and returned to the head of the lines several times. The Antelope priest then took from the *kisi* the wad of cornstalks and vines and put it in his mouth, as the Walpi priests do the snake. The Snake priest accompanied him, placing his left hand on the shoulder of his companion and acting as the "hugger." In this way the two men pranced slowly between the lines of swaying priests, who stepped forward and backward one step, the Antelopes singing and shaking their rattles. The carrier held the wad in his mouth like a pipe, and after a few courses he was relieved by another priest. After this was continued several times, the wad was returned to the *kisi*, the asperger sprinkled water, and the Snake and Antelope priests filed away in turn, each making circuits of the plaza. No warrior with a whizzer accompanied the procession, and although one of the Antelopes wore a garland of cottonwood leaves, he did not call out at the *kisi* the foreign words, "*Tcamahía, awahía*," etc.

The Snake Race

On the morning of August 23, before daybreak, the Antelope priests sang their songs and consecrated the trays of *pahos* before the altar. I regret to record that I was too late to see this ceremony, although I reached the kiva before sunrise. There is every probability that the songs rendered at that time correspond with the sixteen songs, with dramatic accompaniment, which I have observed at Walpi, but as *pahos* were not made in numbers on previous days, it is not probable that a similar ceremony occurred on the other mornings.

When I arrived at the pueblo from my camp near the spring, the "Snake race" was already taking place in the valley between Cipaulovi and Cuñopavi, and all the Antelope priests were seated on the rocky ledge west of the kiva watching for the return of the racers. The race was well attended, many young men from Micoñinovi and Cipaulovi contending, and its termination was clearly visible from the mesa top. It presented no important differences from the Snake race at the other villages; the winner ran up the trail past the Antelope kiva, and the prize seemed to be simply the reputation which it gave him as a runner.

Directly after the return of the racers, a number of boys and girls, who had been standing on the edge of the lower terrace, where lies the trail along which the racers approached the pueblo, started all together

to run up the hill to the town. They carried cornstalks, melons, and other objects, and many of them wore small ceremonial kilts and had their bodies decorated with various pigments. As they approached the houses men and women from the spectators ran down to meet them, and, when possible, seized the objects which the children bore. This afforded much pleasure and amusement, and closely resembled what has elsewhere been described in connection with similar races.

Directly after them came a man personating a warrior. He wore a white kilt and an antelope skin, and at intervals twirled a bullroarer or whizzer. He, unlike the winner in the race, returned to the kiva accompanied by all the other Antelope priests. They sat in a circle about the fireplace, smoking and exchanging terms of relationship. After all had smoked, beginning with the chief and ending with the pipe-lighter, each man took a pinch of ashes in his hand and remained silent, squatting on the floor. One of their number sang in a low tone, and as it continued each man turned his hand about his head several times in a circular pass, spat on the ashes, which he then cast out of the hatch. Immediately afterward a bundle of dried roots was passed about, each priest nibbling a little thereof, after which he spat on his hands and rubbed them over his chest. This ceremony was purificatory in nature.

Many *pahos* were still in the basket trays, and when the winning racer approached, the Antelope chief came out of the kiva and presented one of these to him. At the termination of the race, the warrior[1] bearing the crook deposited the feather, which he wore in his hair, on the Antelope altar.

The Snake Dance

The Snake dance at Cipaulovi, as in all the other Tusayan pueblos, took place just before sunset; it was well attended by people from the other villages, and included the four Americans in my party. The dance itself was almost identical with that at Walpi, although much smaller in the number of participants.

There were fifteen Antelope and thirteen Snake priests. When the time arrived for the dance, the chief of the Antelopes, who had been dressing in their kiva, went to the hatch of the Snake kiva and asked the Snake chief if he were ready. Immediately after his return, the Antelope priests filed out of their chamber into the plaza where the *kisi* had been erected. Their chief carried his badge of office, or *tiponi*, and he was followed by a priest holding in both hands a medicine bowl and aspergill. This man, however, did not, as in other Snake dances, wear a garland of cottonwood leaves, nor did he cry out the mystic words, "*Tcamahia*," etc., which formed such a conspicuous feature in the Walpi ceremony. There was likewise no personification of a warrior (*kalektaka*) bearing the whizzer or bullroarer.

[1] This was the man who stood at one of the goals in the race.

The Antelope priests made four circuits of the plaza, in the space to the southward and eastward of the shrine and *kisi*, shaking their rattles as they marched, and dropping a pinch of sacred meal in the shrine as they passed it. Each man stamped on the plank before the *kisi*, dropping meal as he did so, and then the whole line formed a platoon facing eastward, where they stood shaking their rattles.

Immediately the Snake men followed, making four circuits of the plaza, their course being much longer than that of the Antelope priests. As each priest passed before the *kisi* in these circuits, he stamped on the plank, after having dropped upon it a pinch of sacred meal. They then lined up in front of the Antelope priests, and sang songs similar to those at Walpi. There was no call, however, to the warrior gods by an asperger. Among other episodes at Cipaulovi, I missed that quivering movement of the snake whips, elsewhere described.

The line of Snake men next divided into groups of three—each trio composed of a "carrier," a "hugger," and a "gatherer." The carrier knelt down before the *kisi*, received a snake from a man within, put it in his mouth, and began the circuit of the plaza. He did not close his eyes, as do the performers at Walpi, and the hugger simply placed one hand on his shoulder. The carrier did not touch the snake, as at Oraibi, after he had placed it in his mouth; and, instead of throwing the reptile from him when he had completed the circuit, he took it out of his mouth and laid it on the ground at a certain place. The gatherer picked up the snake, not confining his attention to the carrier whom he followed, and not first throwing meal to the sun or sprinkling it on the reptile, as at Oraibi. As the carrier started on his circuit, he tucked his *paho* in his belt. The *pahos* used at Walpi were made by the Snake priests; those employed at Cipaulovi were made by the Antelope chief and given to the Snake men.

As the snake carrier left the *kisi*, in his circuit, the asperger sprinkled him with medicine, but no maidens stood near to throw prayer-meal upon them, as at Walpi. After all the snakes had been carried in the mouths of participants in the dance, the Snake chief made a circle of sacred meal about 20 feet in diameter in front of the *pahoki*, and drew in it six meal radii, corresponding to the six cardinal points. The reptiles were then thrown into this ring, and the asperger sprinkled them with medicine, after which the maidens and women threw sacred meal from their basket plaques upon the writhing mass. At a signal the Snake priests rushed to the reptiles, seized as many as they could, and, as at Walpi, departed hastily down the mesa trails and distributed them to the cardinal points. As they left the plaza, a perfect rain of spittle from the spectators on the surrounding housetops followed them.

The subsequent vomiting and feast differed in no essential particulars from the same episodes at Walpi.

There were among the spectators numerous prominent Snake men from Walpi, including Kopeli the Snake chief, Supela his father, and Saliko

his mother. The former did not enter the kivas; and the last mentioned, who came to Cipaulovi the night before the dance, told me she prepared the "antidote" for the priests at Cipaulovi, as at Walpi. In essentials the public Snake dance in the pueblos last mentioned is similar, and the dress of the Snake and Antelope men practically identical. It would seem as if the ceremony were derived from Walpi rather than from Cuñopavi.

The Snake dance at Cipaulovi, as will be seen from the foregoing account, is abbreviated in character, small in number of participants, and curtailed in secret rites. On August 21 (*komoktotokya*), the day before the Antelope dance, the chief went off in search of wood, leaving his altar for a long time, with no one in the kiva for several hours. Such a proceeding may be more primitive, but it never happens at Walpi. While at Walpi the sand picture and altar of the Antelopes are prepared on the first day (*yüñya*), they are not made until the sixth or seventh day at Cipaulovi, or, more accurately speaking, the third day before the Snake dance. This in itself introduces a modification in secret ceremonials. The *awata natcis*, or bows with red horsehair, were not hung upon the ladders before the eighth day, and were first seen on the ninth; at Walpi, they were placed there on the fifth day. All ceremonials with a snake *tiponi* were obviously omitted, and there are several complicated rites at Walpi which probably are absent in the Snake villages of other Tusayan pueblos.

THE CUÑOPAVI SNAKE CEREMONY

General Remarks

The ritual of this Tusayan village is less known than that of any other, not a single Cuñopavi ceremony ever having been described. There is, however, evidence that the complete Tusayan ritual is performed at this pueblo, and its age and isolation leads me to suspect that the modifications are of value from a comparative point of view. It is, therefore, with great pleasure that I am able, in this article, to present the results of the first study of Cuñopavi ceremonials. Unfortunately, however, I can speak only of the public Snake dance and describe the Antelope altar, since I have not witnessed any of the secret rites pertaining to the ceremony.

The attendance at the Snake dance of Cuñopavi, in 1896, consisted of ten white persons and numerous Indians from the other mesas, in addition to the inhabitants; there were also two Navahos, who had come from a long distance.

The Antelope Altar

The sand mosaic of the Cuñopavi Antelope altar (plate LXXII) was bordered by a margin of sand of four colors—yellow, green, red, and white, separated by black lines—and was of rectangular shape, about the size of the Walpi altar. There were but two rows of semicircular rain-cloud figures in the inclosure of the margin. The first row, adjacent the margin, had four members—yellow, green, red, and white, in sequence, beginning at the right of the row. The second series had five semicircles—yellow, black, yellow, green, and yellow, following the same sequence as the former. There were four zigzag lightning symbols, colored yellow, green, red, and white, each of which had a horn on the right side of the head. At the angles of each lightning symbol there were drawn, with black sand, figures of feathers. The zigzag lightning strokes and the semicircular rain clouds were outlined with black lines, and parallel lines representing falling rain were short and numerous. As at Cipaulovi, there were no stone implements around the margin of the sand picture, but at its four corners there were small cones of clay, each bearing the color of a cardinal point—yellow, green, red, and white, respectively. The front and rear margins of the sand picture, like those of the Cipaulovi altar, were destitute of objects. On each side of the sand picture there were four clay pedestals, two of which bore straight

sticks and two supported sticks crooked at the extremities. The *tiponi* was placed on a small hillock of sand somewhat back of the rear right-hand corner of the sand picture. In the rear of the left-hand corner, leaning against the wall of the kiva, were two rectangular slabs, the symbolism on which was not distinct, recalling the so-called Butterfly virgin slab of the Walpi Antelope altar. Around them were tied strings with appended *nakwákwoci*.

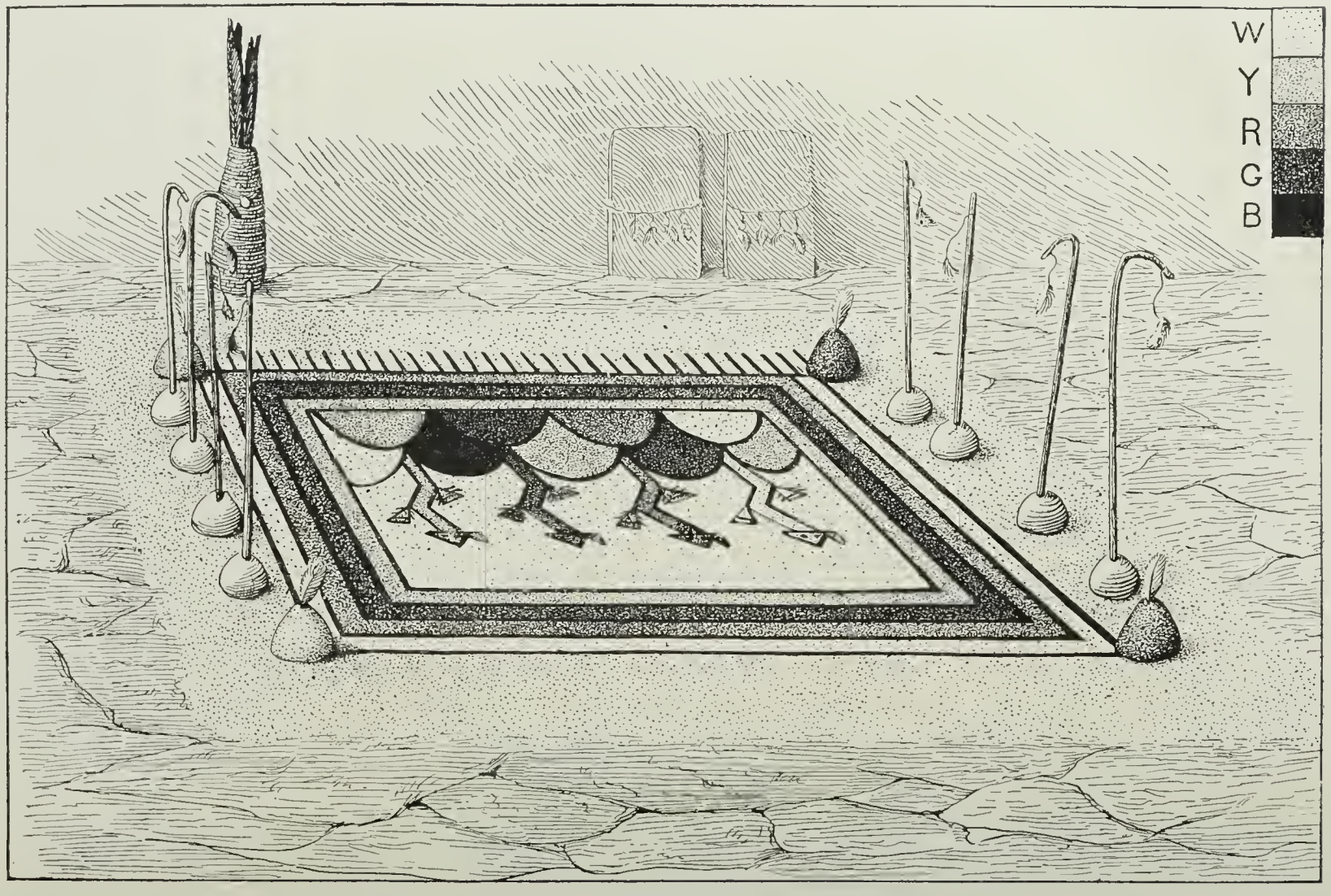
At the time I studied the Cuñopavi altar of the Antelopes there were finger marks on each rain cloud of the sand picture, where the chief had taken a pinch of each colored sand to carry to his field, these being symbolic of the different colored corn which he hoped would grow there.

The Snake Dance

The Snake dance at the pueblo of Cuñopavi was performed on August 24, and was the only event of this complicated observance which I witnessed. While, therefore, my observations were limited, they constitute the first ever made by an ethnologist in this interesting and little known pueblo. Seventeen Antelope and eighteen Snake priests participated in the ceremony; each Antelope carried two [1] rattles, one in each hand, and there were three small boys among the Antelope priests, one of whom could not have been more than five years of age. The youngest of the lads was naked, but painted like his elders, and when he lined up with the other Antelopes before the *kisi* he held his place without shrinking, even when the venomous rattlesnakes crawled near him, an exhibition of infantile pluck which I have never seen excelled. This is not simply want of fear through ignorance, for again and again in their songs and talks the priests pray that they may not be bitten. He must have known the power of the snakes, but the same belief which controlled his elders gave him courage. The Cuñopavi priests handled the rattlesnakes more fearlessly, if that were possible, than the participants at any of the other pueblos.

The differences noted between the events and paraphernalia of the Antelope and Snake men at Cuñopavi and the other villages were the following: In addition to cottonwood boughs the *kisi* had cornstalks in its construction and a circle of sacred meal was made about it. The costume and body painting of the Antelopes were the same as at Walpi; there was no warrior with a whizzer or bullroarer, and the asperger did not call out the invocation to the cardinal points. The kilts of the Snake priests were as a rule without rattles, and the parallel lines with which the zigzag figure of the plumed snake were marked extended across the figure. The bandolier was cylindrical, the medicine pellets few or wanting.

[1] This is an interesting innovation at Cuñopavi. At Walpi and Oraibi each priest carries but one rattle. These rattles are made of buckskin stretched over a pair of circular disks and fastened to a wooden handle; they contain small objects for rattles, and are painted white.



ALTAR OF THE ANTELOPE PRIESTS AT CUÑOPAVI

After the entrance of the Snake and Antelope men and their preliminary songs, which resembled those of Walpi, the Snake chief went inside the *kisi* and passed out the snakes. Before carrying these reptiles, the Snake priests made the circuit of the plaza in trios, the carrier, hugger, and gatherer posing in the same way as when they bear the snakes. This, of course, was subsequent to the four circuits made in line by the Snake priests when they entered the plaza and stamped on the plank before the *kisi*. The snake carrier handled the reptile, as at Walpi, putting it in his mouth, and did not touch it afterward with his hands, as at Oraibi; his eyes were open as at Cipaulovi and Oraibi. The hugger simply placed his hand on the right or left shoulder of the carrier and stood behind him, not putting his arm about the carrier's neck, as at Walpi. After all the snakes had been carried, and while they were in the gatherer's hands, the Snake priests crowded about the entrance to the *kisi*, and something occurred which was not observable to the spectators. The circle of meal was next made some distance away; the reptiles were then thrown within it, and the women sprinkled or threw their plaques full of meal upon the snakes. The priests then rushed in, seized the reptiles, and darted away, as elsewhere described. As they left the plaza all of the spectators spat after them, as at Cipaulovi. Then occurred something which had never before been witnessed in any of the six presentations of the Snake dance which I have observed. Several of the Snake priests did not obtain reptiles from the writhing mass in the ring of meal, and consequently did not rush down the steep mesa trails with those who did, but they made the circuit of the plaza four times before the *kisi*, sprinkled meal on the *sipapû* and stamped on the plank, after which they filed off to their kiva. It was not clear to me whether this was accidental or an unusual modification; but I am inclined to think that the number of reptiles was so few that these priests could not obtain any with which to rush down the mesa, and this way of retiring to their kiva is prescribed in such a case.

THE ORAIBI SNAKE CEREMONY

General Remarks

On account of the isolation of the pueblo and the persistent way in which its people have resisted innovations, the presentation of the snake ritual at Oraibi has long been regarded as the most primitive of all the Hopi ceremonials.

In an article[1] on the "Ancient Province of Tusayan," Major Powell partially described an Oraibi ceremony, but too briefly to be identified. So far as I know this was the first account of Tusayan kiva rites. A large oil painting of a Tusayan ceremony and altar has long hung in the pottery court of the National Museum. This painting, I am informed by Major Powell, was made under his direction and represents a scene in a Tusayan kiva. Several priests, apparently engaged in rites about a medicine bowl, are figured, and from the arrangement of the maize of different colors about it I suppose the picture represents the making of charm liquid. The attitude of the priest in the act of blowing smoke into the bowl confirms me in this interpretation.

The representation of the reredos is unlike anything which has been reported from Tusayan. The room has a hatchway, but is unlike any Oraibi kiva which I have seen.

In 1895 I figured and described[2] the altar of one of the Flute societies at Oraibi. Mr H. R. Voth, a resident missionary, has recently given much time to the study of the Oraibi ritual, and has shown me several sketches of highly characteristic altars, accounts of which he intends later to publish. We are, therefore, on the way to a more exact knowledge of the ceremonials, religious paraphernalia, and altars of this interesting pueblo which has so long resisted the efforts of ethnologists.

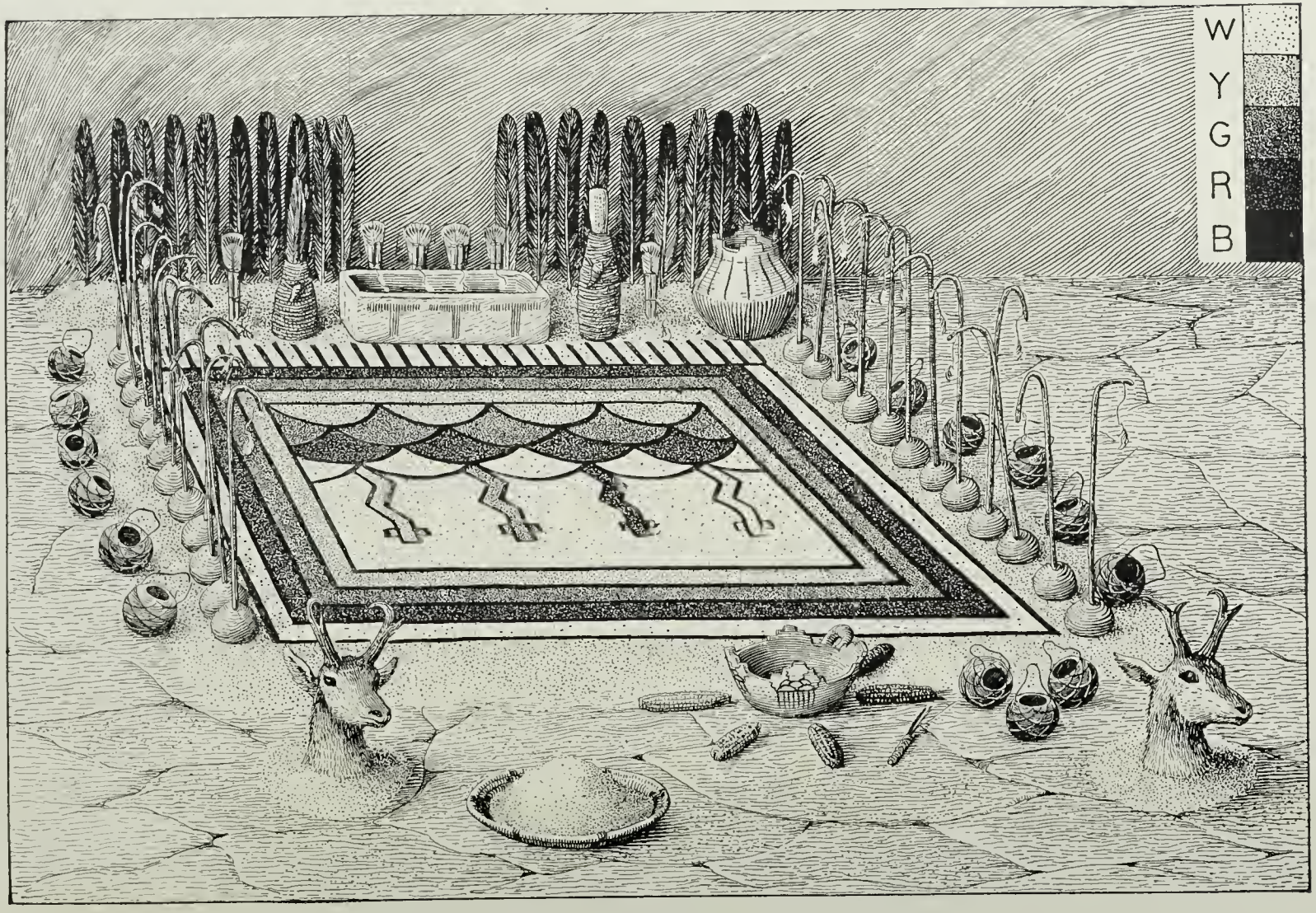
The Antelope Altar

The Antelope priests at Oraibi were not overgenial to strangers wishing to pry into their secret rites, and the Snake priests positively refused to allow me or any white man, except the missionary, Mr Voth, to enter their kiva.[3] I entered the Antelope kiva uninvited, but my

[1] Scribner's Magazine, Vol. XI, No. 2, New York, December, 1875.

[2] The Oraibi Flute Altar; Journal of American Folk-lore, Vol. VIII, Oct.-Dec., 1895.

[3] One or two white men told me that they ventured into the Snake kiva when the priests were away and saw nothing there but stone images, probably twins, or the Little War Gods. As the Snake chief at Oraibi has no *tiponi*, he makes no altar, and the stone image was the tutelary god of warriors, known as the Little Gods of War, Püükoñhoya and Palunhoya.



ALTAR OF THE ANTELOPE PRIESTS AT ORAIBI

presence there was not welcome, and most of the half hour which I spent there was occupied in reasoning with the priests. I succeeded in making a sketch of their altar, but was several times ordered out, and was therefore not loth to leave the kiva when I had finished. There was some little satisfaction in being able to tell the priests of Oraibi in their own kiva that my studies of Antelope altars in other pueblos enabled me to interpret about every object which theirs possessed, since they were so similar. This, however, was not strictly true as regards all the fetishes, for there were two or three objects on the Antelope altar at Oraibi which are different from those at Walpi, Cipaulovi, and Cuñopavi, and beyond my comprehension.

The size of the Antelope altar at Oraibi (plate LXXIII) was about the same as that of Walpi, and the sand picture almost identical, so that a description of this portion of it would be a duplication of accounts elsewhere published.[1] The sand picture was surrounded by a yellow, green, red, and white border of sand. There were semicircular figures of rain clouds in yellow, green, red, and white, arranged in the same order as at Walpi, and in like sequence. The four lightning symbols, however, differed somewhat, all of these having square appendages to the heads, instead of horns and diagonally marked rectangles. These square appendages, as nearly as I could make out, were on both sides of the heads, but accuracy in this minute particular was next to impossible. There were no stone hoes about the border of the sand picture, as at Walpi. Along each side was a row of clay pedestals, in each of which were inserted straight or crooked sticks, to the tops of which were attached red-stained *nakwákwosis*. They were arranged side by side and there were no breaks or "gateways," as at Walpi. At the side of each crook a small netted gourd was placed. At the end of each line of sticks, one on each side of the altar, there was a head of an antelope, with horns, nose, and neck. These objects are not found on the Antelope altars of Walpi, Cipaulovi, or Cuñopavi, and are significant accessories in the secret ceremonials.

The floor in front of the altar had no pedestals with upright sticks, but upon it was a medicine bowl, the six-directions corn, and an aspergill.

The rear of the altar was strikingly different from that of any Antelope altar which has been described. There were no stone fetishes of animals, as at Walpi, and although the two *tiponis* were present, both of these belonged to the Antelopes. The Snake society at Oraibi, as at Cipaulovi and Cuñopavi, has no palladium or *tiponi*. These two objects stood just in the rear of the margin of the sand picture, one on each side of a square medicine bowl, which occupied the middle and therefore corresponds in position to the mountain-lion fetish on the Walpi altar. Projecting from the top of the left-hand *tiponi* was an object which, from my point of observation, resembled a stone implement, but

[1] Jour. Amer. Eth. and Archæol., Vol. IV, pp. 17–24.

in other respects the two *tiponis* resembled those of the Walpi altar. *Pahos* were placed upright near each *tiponi*, and from one of these a long string, with feathers tied to the extremity, was stretched across the sand picture.

The medicine bowl back of the altar had three T-shape figures painted upon it, and behind this vessel there were four *pahos* placed upright with strings drawn over the top of the medicine bowl. At the extreme left of the rear of the altar there was an ancient vase with terraced elevations. Back of all the objects at the rear of the altar there was a ridge of sand in which was inserted a row of eagle wing feathers. Between the rows of crooks and the lateral margin of the sand picture long *pahos* were laid lengthwise on the floor. A basket of sacred meal was placed on the floor near the right-hand effigy of an antelope head.

It will be seen from an examination of the details of the Antelope altar of Oraibi and comparison with those of Cipaulovi, Cuñopavi, and Walpi, that it is the most complicated and has several objects not elsewhere duplicated. Moreover, the arrangement of the objects back of the altar is such that it would be quite strange, indeed almost impossible, for the Antelope chief to introduce several of the events which occur in the sixteen-song celebration at Walpi.

The Antelope Dance

The Antelope or Corn dance at Oraibi took place at sunset, as in the other villages, but it was not so brilliant a spectacle nor was it performed by so many priests as at Walpi. The Antelope priests, headed by their chief, marched directly from their kiva to the *kisi*, and made four circuits of the plaza, each priest stamping on the depressed plank as he passed before it.

After they had formed a platoon, the Antelope chief drew a line of meal in front of them, and at the extreme end of this line he set his *tiponi* upright on the ground. At one side of this badge, also on the line of meal, the asperger deposited his medicine bowl. Each Antelope then placed the netted gourd and stick which he carried on the ground before him, so that all these objects were arranged in a row before the platoon of Antelope priests.

The Snake men came out of their kiva and made four circuits of the plaza in front of the line of Antelope priests, who shook their rattles as the Snakes passed before them. Each Snake priest dropped a pinch of meal and stamped vigorously on the plank as he passed the *kisi*, and then took his place in line before the platoon of Antelope priests. They were led by their chief, an old man, who, however, had no badge of office on his arm. The Antelope priests wore feathers in their hair and a small white feather on the crown of the head. The asperger was distinguished by a fillet of cottonwood leaves. Their bodies were painted with zigzag lines in white, but all wore heavy shell and turquois necklaces. Each priest, except the asperger, carried a rattle in the right hand and a stick and water gourd in the left.

Entrance and circuit of the Antelope priests

Entrance of the Snake priests

THE ANTELOPE DANCE AT ORAIBI

Platoons of Antelope and Snake priests at the opening of the dance

Snake priests shaking their whips

THE ANTELOPE DANCE AT ORAIBI

Line of Antelope priests

The asperger carrying the wad of cornstalks and bean vines

THE ANTELOPE DANCE AT ORAIBI

The chief bore his *tiponi* over his left arm. All wore white dance kilts with rain-cloud decorations, and a characteristic sash. Several had bandoliers of yarn over the right shoulder and a hank of wool on the left knee, but none of the Antelope priests wore moccasins and but few had fox-skins dangling from their belts. The position of the chief was at the extreme right of the line. An old Antelope priest carried an ear of corn.

Each of the Snake priests wore a small red feather in his hair, but their faces were not painted; all, however, had daubs of white pigment on their arms and legs. Several had hastily tied white kilts, similar to those of the Antelopes, about their loins, and only two had the characteristic snake kilts. Each carried his snake whip in his right hand, a bag of meal in his left, and most of the performers wore moccasins. None had necklaces, fox-skins, or bandoliers. The platoon of Snake men stood some distance from the Antelopes, with a lad on the extreme right. As the Antelopes sang and shook their rattles, the Snake men bent slightly forward, pointing their whips toward the ground, then moving them backward and forward with a waving motion. As the music continued, the asperger, not leaving his position by the side of the Antelope chief, called out in a low voice the words "*Tcamahia*," etc, several times.

After he had ceased, he went to the opening of the *kisi*, and took out one of the bundles of cornstalks, melons, and other vines, put the butt in his mouth, holding the other end in both hands before him. A second priest, putting his left hand on the left shoulder of the asperger, walked behind the carrier, stroking his back with a snake whip. In this way the two made several promenades between the platoons of Snake and Antelope priests, the former singing and shaking their rattles, all with netted gourds and sticks in their left hands. As this proceeding continued the Snake priests stepped backward and forward in line, poising themselves first on one leg and then on the other.

At the conclusion of this dance the Snake priests filed about the plaza, making the circuits before the *kisi*, and returned to their kiva. The Antelope priests did the same, but went to their own ceremonial chamber. This closed *totokya* (August 18), so far as public ceremonies were concerned.

The Snake Race

A snake race of Oraibi took place at sunrise of the same day on which the Snake dance was celebrated, as at Walpi, Cipaulovi, and Cuñopavi.

The Snake Dance

At a short time before sunset, on August 19, the Antelope priests filed out of their kiva and made four circuits in front of the *kisi*, each stamping on the plank and dropping a pinch of meal as he passed. They were headed by the chief, who carried his *tiponi* on his left forearm. The chief in turn was followed by the asperger, who wore a

chaplet of cottonwood leaves and carried a medicine bowl and aspergill with both hands. Each Antelope wore a white "breath-feather" in his hair, which hung down his back, but none had a bunch of feathers on his head. The chin was painted black and there was a white line along the upper border of the black from ear to ear across the upper lip. All wore necklaces of shell or turquois and each was adorned with zigzag lines of white pigment along the body, on each breast, from shoulder to belt, continued on the back on each side to the waist. There were also zigzag white lines on the arm, and the forearm was painted white. Each wore a bandolier of woolen yarn over the right shoulder, and everyone, save the asperger, carried a rattle in the right hand. All the dancers wore kilts and embroidered sashes, with pendent fox-skins behind, and all had moccasins. Thus appareled they lined up in a platoon, the chief at the left, the *kisi* midway in the line, shaking their rattles while awaiting the Snake priests.

The Snake priests then came from their kiva headed by their chief, who had no *tiponi*. Each Snake priest wore a bunch of feathers in his hair, and curious feathered objects on the back of the head. Their faces were blackened, but there was no white paint on the chin. All wore shell and turquois necklaces, armlets, and wristlets, and daubs of white on their foreheads, breasts and backs.

Their kilts were colored red, with zigzag figures of the plumed snake, bearing tripod-shape and alternate parallel bars as ornaments. Less than half their number had a fringe of antelope hoofs on the lower edge of the kilt; all wore fox-skins pendent from their loins, turtle-shell rattles on the leg, moccasins stained red with sesquioxide of iron, and red wristlets. Each carried a snake whip. After the preliminary forward and backward steps, and after shaking their whips in unison with the songs of the Antelopes, they divided into groups of three, called carrier, hugger, and gatherer.

The snakes are carried at Oraibi in a way peculiar to this pueblo and differently from that adopted in any other Tusayan village. The posture of the hugger is likewise exceptional. When the carrier approaches the *kisi* in which the snakes are confined, he places his whip in his belt, seizes the reptile, puts its neck in his mouth, with head pointing to his left, and grasps the body of the snake with his two hands, the right above the left. The carrier does not close his eyes, and he takes but one reptile at a time. In this way he ambles about the plaza in a circle, the center toward his left. When he has completed the circuit, he takes the reptile from his mouth and lays it on the ground, with the head pointing away from the *kisi*. The hugger follows the carrier, placing his left hand on the left shoulder of the carrier, whose back he strokes with the snake whip. He stands behind the carrier, and not at his side, as at Walpi. The gatherer picks up the reptiles after they have been placed on the ground. If the reptile coils for defense, he strives to make him uncoil by movements of the whip; otherwise he takes a little

Entrance of the Antelope priests

Circuit of the Antelope priests before the kisi

THE SNAKE DANCE AT ORAIBI

Antelope priests awaiting the Snake priests at the kisi

Preliminary circuit of the Snake priests in the Antelope dance

THE SNAKE DANCE AT ORAIBI

The dance before the reptiles are taken from the kisi

The snake carrier and the hugger

THE SNAKE DANCE AT ORAIBI

sacred meal, says a prayer, casts a pinch to the setting sun, sprinkles a little on the head of the reptile, and suddenly grasps the snake back of the head. The gatherers collect the snakes whenever dropped by the carriers, and hold them in their hands as the others are borne about the plaza.

The women did not stand in line and sprinkle the Snake priests with meal as they passed with their burdens, but when the reptiles were thrown in a heap, after the dance, both maids and matrons emptied trays of meal upon the snakes on the ground.

After all the reptiles had been carried about the plaza in the way indicated above, they were thrown in the middle of a ring of sacred meal, marked with six radii, also of meal, corresponding to the cardinal points, the zenith, and the nadir. At a signal the Snake priests rushed to the circle, seized all the snakes they could gather, and darted off with them down the mesa sides to the four quarters, where the reptiles were deposited. Later they returned, divested themselves of their scanty clothing, retired to a secluded spot, bathed, took an emetic (?), and vomited. The Antelopes meanwhile made four circuits in front of the *kisi* and retired to their kiva. As at Walpi, the Snake men feasted at nightfall, not having tasted food on the day of the dance.

In reviewing the details of the Snake dance at Oraibi, as described above, we are impressed, first, with the small number of participants, eleven Antelope and fifteen Snake priests; secondly, with the peculiar manner of carrying the reptiles; and, thirdly, with the lack of brilliancy in the personal adornment of the performers. The entrance of the Snake chief, Kopeli, at Walpi, followed by his band, is a most striking affair, full of life and startling in character. At Oraibi this part is very tame in comparison, without dash or excitement, and fails in vigor, energy, and power. The number of participants at Oraibi, not a third of those at Walpi, is also disappointing to one who has seen the dance at the East Mesa. I can, however, well believe that the Oraibi Snake dance more closely resembles that of Walpi before the advent of so many visitors, than does the present exhibition at the latter pueblo. Everything at Walpi shows a vigorous cult, a popular society, an earnestness as great as at Oraibi, but the primitive character of the whole is somewhat spoiled by the introduction of gaudy ribbons, ornaments, and personal decorations purchased from the trader.

DIFFERENCES IN ACCESSORIES

General Remarks

The most striking differences in such events as were witnessed in the Snake dance presentations thus far recorded have been noted in the preceding pages. None of them are of sufficient importance to indicate more than local modifications. The strong likenesses which one ceremony bears to the other indicate the same cult and a common origin.

It would, I believe, be a little short of puerile to ascribe the Snake ceremonials in the different Tusayan pueblos to independent evolutions, so close are their similarities in details and so definite are the legends of their common origin. There is, however, an aspect of the study of Snake dances among other pueblos which merits more serious attention, to the intelligent discussion of which exact data on the Tusayan variants may be of value. From a study of the amount of variation in the same rite in these five pueblos, we may obtain a knowledge of the limits of variants which will be of service in comparative studies.

The following are some of the features in the Snake ceremonies which, I am told, did not occur at Oraibi[1] and Cipaulovi:

I. The singing of a series of sixteen songs on the first four days.

II. The personification of the bear and puma, and accompanying rites.

III. Ceremonial mixing of Snake medicine.

As there was no Snake altar at Oraibi, Cipaulovi, or Cuñopavi, the reptiles were not thrown across the room, but simply dried on the sand, as at Sia.

Both at Oraibi and Cipaulovi, *pahos* of different lengths corresponding to different days and distance of shrines were not made, and as this is a prominent feature in the Walpi variant, its absence has profoundly modified the attendant rites at the other villages, imparting to them many modifications.

Pahos

Most of the *pahos* or prayer-sticks made at Cipaulovi on the day before the Snake dance were of the length of the middle finger, while at Walpi they are of the length of the ultimate joint. One of the component sticks has a flat facet, whereas at Walpi neither has a face. The stick with a facet upon it is the female; the other, the male.

[1]Mr H. R. Voth has made elaborate studies of the secret rites of the Oraibi Snake dance, from beginning to end. His observations, when published, will no doubt throw a flood of light on the unknown portions of the ceremonial.

The Oraibi performance

The Cipaulovi performance

SNAKE PRIESTS WITH REPTILES

Of all the suggestions that have been offered to explain the *paho* on comparative grounds, none seem to me more worthy of acceptance than that it is a sacrifice by symbolic substitute. The folktales of the Pueblos are not without reference to human sacrifice, and offerings of corn or meal would be natural among an agricultural people like the Hopi. Substitutes for human sacrifices to the gods were sometimes made by the Aztecs in the form of dough images, so that the method by substitution, common in Europe, was not unknown in America. When occasion demanded, the Hopi legend says, they sacrificed a child and their chief, but in these days sacrifice has come to be a symbolic substitute of products of the field—corn, flour, or *pahos*—still retaining, however, the names "male" and "female," and with a human face painted on one end of the prayer-stick.

The Kisi

Each of the four pueblos of Tusayan where the Snake dance is celebrated has a *kisi* or bower made of cottonwood boughs, near which the Snake dance is celebrated, and in which the reptiles are confined before they are carried about the plaza. These *kisis* are all very similar in their construction, the only difference which I have detected being the use of cornstalks[1] and reeds with the cottonwood boughs in the Oraibi celebration. All were closed in front by a wagon-sheet or cloth.

The *kisi* at Oraibi is placed in the open space west of the town, that of Cipaulovi in the main plaza, and that of Cuñopavi in the plaza between the westernmost and inner row of houses. The vicinity of the *kisi* to a shrine is peculiar to Cipaulovi.

Snake Whips

The snake whips of the Middle Mesa pueblos are made of two sticks instead of one, as at Walpi, and in some instances have attached packets of cornhusk, presumably containing prayer-meal, which are absent on the Walpi snake whips. These may thus be regarded as true *pahos* or prayer-sticks. The neat little fringed bags of buckskin, in which the Snake priests of Walpi carry their sacred meal, I did not see at Cipaulovi or Oraibi, where the meal bags were large and coarse.

Snake Kilts

The snake kilts vary in no important detail in the different villages, except that they are sometimes made of deer or antelope skin, sometimes of cloth, but are always stained red. The zigzag figure in the middle of the kilt is decorated with crossbars alternating with tripod figures, or simple parallel lines. The kilts of the Middle Mesa and Oraibi generally have these bars extending across the figure of the

[1] In the Sia variant cornstalks are said to be used in the construction of the "grotto," which Mrs Stevenson describes as "a conical structure of cornstalks bearing ripe fruit." This "grotto" I regard as the Sia equivalent of the Tusayan *kisi*.

snake. The lower fringe may be of tin cones or antelope hoofs, or they may be destitute of all appendages, according to the pueblo. Tin cones are universal at Walpi.

The feathers on the heads of the Snake priests vary in the different pueblos, especially those hanging downward on the hair behind. The antelope kilts are similar, and the sashes, fox-skins, and belts identical. The other striking differences have been mentioned in the account of the dance in each pueblo.

The absence at Cipaulovi, Cuñopavi, and Oraibi of the personification of the *kalektaka*, or warrior, who carries the bow and arrow, and who twirls the whizzer, is noteworthy. At Walpi this personage appears in the rear of the line of Antelopes as they enter the plaza, then stands at the extreme left of the platoon, and is the last to leave the *kisi* at the close of the dance. He uses the whizzer at critical times in the ceremony, and has appeared in the three Walpi Snake dances which I have witnessed. He was not, however, seen in any of the villages where this ceremony was celebrated in 1896.

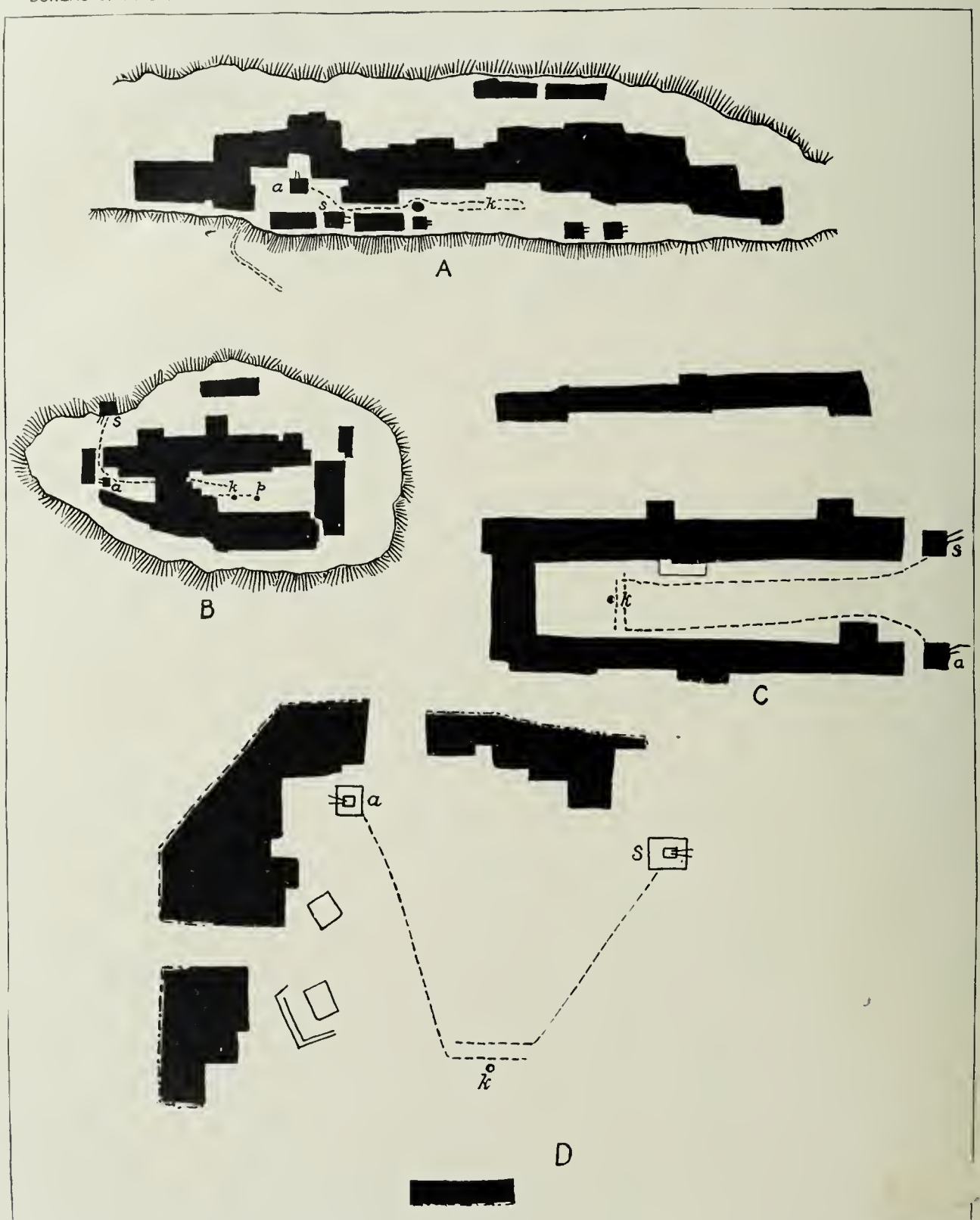


DIAGRAM SHOWING POSITIONS OF KIVAS, KISIS, SHRINES, AND PARTICIPANTS IN THE SNAKE CEREMONIALS

a, Walpi *b*, Cipaulovi *c*, Cuñopavi *d*, Oraibi

THEORETIC DEDUCTIONS

When we attempt to analyze the Tusayan ritual, we are led to suspect that the similarities in the great ceremonials are in part results of composition. The Tusayan people have been made up of increments, which have gradually assimilated, as history and legends describe. Each of these additions brought its own ceremonials, some of which were still practiced, and have been transmitted to descendants, surviving to the present day. The ritual has thus come to be one of composition, not of replacement.

Christianity had a like reception when it came among the pueblos. It was engrafted on the Pagan system, and so long as it was not thought to be aggressive it was welcomed; but so soon as the new cult sought to replace existing rites, it encountered resistance. Each priesthood held that its rites were efficacious, and those of associate societies were likewise good; but when any one of these priesthoods declared those of another bad, a position which to their minds was illogical, since the priests of one fraternity do not know the secret rites of another, an unusual condition arose. As history shows, there was no objection to Christianity at its advent, and it took its place with numerous Tusayan cults, in their system; but the attempt to overthrow the latter led to the hostilities which culminated in 1700.

The several components which formed the Tusayan people practiced ceremonials similar in general character, but different in details. As they became united, each retained certain of its ceremonials, which have been transmitted to our time. The similarities we detect show how close these components were.

The comparative studies of the Snake presentation which I have made in the three pueblos that celebrate this drama in the even years have led me to the conclusion that in my previous publications sufficient emphasis has not been placed on the corn worship which runs through it. The recognition of this element I owe more especially to studies of the Flute ceremonials, which, as I have insisted, are in many respects akin to the Snake dances.

As will be seen by a study of the altars of the Antelope priests, they are destitute of any idol, so that no clew can be obtained from that source in regard to the deity addressed. There are in each, however, figures of rain clouds, which prove, so far as they go, the correctness of the belief that rain worship is at least one of the most prominent features. The fetish of the War god in the Snake kiva of Oraibi is

evidently a special feature as a guardian of warriors, and of small significance in a broad discussion of the meaning of the Snake dance.

Looking over the participants in the secret ceremonials of the Antelope kiva of Walpi, there are but two celebrants whom we can identify as personators. The Antelope priests, save possibly their chief, are simply celebrants, but the boy and girl who stand in the corners of the kiva must be something more; they represent some personage, and consequently I have reflected on their identity. The names given me for these two children are the Snake-youth and the Snake-maid. These names are, I believe, simply cultus-hero names applied to them because of the societies which celebrate the rites. Who the Snake-boy really is I am not yet prepared to say, but I think the Snake-maid is simply a personation of the Corn-maid, and these are my reasons for that belief:

A supernatural being or mythological conception may be represented by Hopi priests in several ways. There are three methods which occur to me—(1) a symbolic picture, (2) an image, and (3) a personification by a man, woman, or child. Designs on the reredos of altars, sand mosaics, altar slabs, and the like, are examples of the first. The rain clouds on the Antelope sand picture, the painted sun disks in the *Palülükonti* screen drama, are symbolic of the supernaturals which they represent. Images likewise represent certain gods; but they are not the gods, only symbols in graven forms, as figures are symbolic pictures. The third and highest form are personifications by men, women, or children. When necessity compels, or for practical reasons, these personifications are simply represented by symbols, effigies, or idols. Instead of a man representing the sun, we have a painted disk. This is carried out in different presentations of the same ceremony accordingly as it is elaborated or abbreviated. Thus, in one presentation of the *Mamzráuti* a woman was dressed like a certain goddess, but in another this personification was replaced by a picture of this supernatural on a board; both had the same name, both the same intent. Practical reasons led to a personification in one and a symbolic picture in the other presentation of the ceremony.

Bearing this thought in mind, let us return to a study of the Snake-maiden. When we compare her with other personifications in the Tusayan ritual, we find she is clothed in precisely the same manner, wears the same symbols, and in every way is identical with the girls in the Flute ceremony; she is, in fact, the same personage. Our studies, therefore, naturally lead us to ask who the girls of the Flute ceremony represent. We have more to guide us in this search.

The girls in the Flute are called the *Lenya-manas*, or Flute-maids, a name applied also to certain figurines on the Flute altars. This name is likewise a sacerdotal totem name of cultus heroes or tutelary deities of a Flute society.

The images of the Flute-maids on the altar represent the Corn or Germ maids. Of that there is proof, because they are sometimes

called by that name and they have figures of corn painted on their bodies. Images of the same, highly elaborated into dolls, are known by the secular name, *Calako* (Corn) maids. These dolls have characteristic symbols on the cheeks, the same rain-cloud ornaments on the head, a figure of an ear of corn on the forehead, eyes of different color, and painted chins. A *Calako-mana* is the same as the effigy of the Flute-maid on the Flute altars, only with another name. In the *Lálakonti* she is called the *Lakone*-maid, and in the *Mamzráuti* the *Mamzrán*-maid, indicative of the society on whose altars they stand, just as the *Lenya*-maid in the *Lenya* or Flute society. All are special names of the same personage, the Corn-maid, *Müiyinwû*, the Mother of Germs.

In the secret ceremonials of the Flute it is not practicable to have a personification of the Corn-maid standing for nine days and nights near the altar, and she is therefore represented by an effigy, which is the image spoken of. But it is not desirable that the uninitiated should see this image, consequently it is not brought out on the plaza in public ceremonials. For this reason, at that time the girls personify the Corn-maids. Hence the two maids in the Flute ceremonials represent the same supernaturals as the images. They are the Corn-maids of legends, the Germ-girls, the Mothers of Germs, *Müiyinwû*. If the *Lenya-manas* are the Corn-maids, then *Teüa-mana*, the Snake virgin, *Lakone-mana*, the *Lakone* virgin, and *Mamzrán-mana* are the same. The girl in the Antelope dramatization is therefore a Corn-goddess.

Let us see if the theory that the *Teüa-mana* and the *Lenya-mana* are Corn-goddesses is supported on other grounds.

The Snake-maid in the dramatization[1] holds a bowl, stalks of corn, and bean vines; the Flute girls carry flat wooden slats, called corn *pahos*, on which corn is depicted. The chins of both are blackened, like the image of the *Lakone-mana*, Corn-maid. The entrance of the Flute girls into the town on the ninth day of the Flute ceremony corresponds, according to legends, with the entrance of the Corn-maids. The Snake-maids whom Tiyo is reported to have brought from the underworld, personified by the *Teüa-mana* in the Antelope rites, wore clouds on her head, as do the images of the Flute maids and the girls who personate the *Lakone-mana* in the public dance. She brought all kinds of corn; so likewise the various others with whom she is identical. The so-called Snake-maid is, therefore, simply one of the Corn-maids, and the dramatization[2] in the Antelope kiva at Walpi is connected with her worship.

In ancient ceremonies we may conjecture that the gods were personified in the kivas by men or women dressed in an appropriate way and bearing prescribed symbols. In course of time, however, for practical or other reasons, images or symbolic pictures were substituted for

[1] Journ. Amer. Eth. and Archæol., Vol. IV, pp. 69, 76. The cornstalks and bean vines are carried in the bowl called the *patne*, q. v.

[2] Journ. Amer. Eth. and Archæol., Vol. IV, pp. 76–81.

personifications. The secret ceremonials of the Antelopes are still in that archaic condition, and the Corn-maid is still represented at Walpi by a girl of the pueblo. In the Flute rites, however, the Germ-maids or Corn-maids are represented in the secret ceremonials by effigies on the altar, and in the public part of the dance by persons—maidens of certain prescribed clans.

In the *Lálakonti* we have the same images of Corn-maids as on the Flute altars, and personifications of the same by girls in the public dance. In the *Mamzráuti* the conditions are the same as in the *Lálakonti*.

Were it desirable to extend our comparisons beyond the boundaries of Tusayan to Cibola, we should there find the personifications taken by maids representing the Corn-maids in the *Klahewey* and *Hamponey*, as I have elsewhere[1] described.

By a similar course of reasoning by which we have determined the identity of *Teüa-mana* (Snake virgin), *Lenya-mana* (Flute virgin), *Lakone-mana* (*Lakone*-virgin), and *Mamzráu-mana* (*Mamzráu*-virgin), the associate male or boy, called *Teüa-tiyo*, *Lenya-tiyo*, *Lakone-tiyo*, and *Mamzraú-tiyo* would also appear to be society names of the same personage. In the Walpi Snake-Antelope ceremony he carries a reptile; in the Micoñinovi Flute altar his effigy bears a flute; in the Walpi *Lálakonti* he is *Cotokinunuwû*, a Sky god. The only intimation of his identity would seem to be suggested by the last mentioned. He is the renowned cultus hero appearing in different guises in these four ceremonials. In one of the variants of the Snake legend, however, he is called White-corn, an attributal name, no doubt, which varies in the different ceremonials or religious fraternities.

Two variants of the legend of the Snake society have been published which apparently differ very greatly, but which in essentials are similar, although neither of these pretends to be accurate in details. In the variant first referred to,[2] one of seven brothers, named from different colored corn, sought and found a maiden in a cave inhabited by Snake people, under guidance of a snake. These maidens were dancing, and the great snake chief "took hold of a cloudy substance," and began pulling, when a girl, "Bright-eyes," emerged, and was given to him as a wife. Under her direction, "White-corn," the youth, sought his home, and his bride was known as *Teüawüqti*. When they joined his kindred, it was "noticed" (recognized) that in times of drought her prayers for rain were efficacious. The people desired her to erect the rain-cloud altar of her native home, to which she replied, "Not until a child is born." She later conceived (in a tempest), and the people were glad, because they hoped for a rain chief. White-corn and his wife retired to a distant mesa, and after seven days returned with her offspring, seven reptiles. The people sought in their disappointment to

[1] Journ. Amer. Eth. and Archæol., Vol. I, pp. 46–55.

[2] Legend of the Snake order of the Hopi as told by outsiders. Journ. American Folk-lore, Vol. I, 1888. Snake ceremonials at Walpi; Journ. Amer. Eth. and Archæol., Vol. IV, 1894.

kill the brood, but an old man took them with the mother and father to his house. Something of unknown character happened in that house, and the Snake-woman, her offspring, and the old man vanished. The old man came back alone; the Snake-woman never returned. There are many details which I have omitted, but the essentials to which I would call attention are that a young man, after many adventures, found in a cave inhabited by Snake people a maid, whom he brought to the home of his own kin. She gave birth to reptiles and disappeared. The name of the young man was White-corn; the Snake-maid was associated with rain clouds.

The incidents of the second variant are more detailed. I need not mention them, but will restrict my account to the main outline.

A youth, under guidance of Spider-woman, visited the underworld and had many adventures with several mythic beings. He entered a room where people were clothed in snake skins, and was initiated into mysterious ceremonials, in which he learned prayers which bring corn and rain. He received two maids, associated with clouds, who knew the songs and prayers efficacious to bring rains. He carried them to the upper world to his own people. One, the Snake-woman, he married; the other became the bride of the Flute-youth. His wife gave birth to reptiles. He left them and their mother, and migrated to another country.[1]

When we examine the legend of this youth, Tiyo, and his adventures in search of the two maids, we see still other evidences of the germ-worship or corn-worship referred to above. In the Snake kiva of the other world the chief told him, "Here we have abundance of rain and corn; in your land there is but little; so thus shall you use the *nahû* [charm liquid to bring them]; fasten these prayers in your breast; and these are the songs you shall sing, and these the *pahos* you shall make (for that purpose); and when you display the white [zigzag lines of kaolin] and the black on your bodies, the clouds will come." When the chief gave Tiyo portions of the different colored sands from the altar, he said, "These are the colors of the corn Tiyo's prayers will bring"—that is, symbols of corn. He gave the two corn-rain maids[2] into Tiyo's keeping—one for himself and one for his younger brother (presumably the Flute chief).

I believe, however, we should not seek to identify too minutely the details of myths or legends in ceremonial proceedings, for undoubtedly the Hopi variants are more or less distorted, changed, and otherwise modified in recital, translation, and transmittal.

The main points are, however, comparable; a cultus hero sought a mythic land blessed with abundance, and brought from that favored place the corn-rain maids, whose worship was powerful in bringing food and rain.

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[1] Journ. Amer. Eth. and Archæol., Vol. IV, pp. 106–119.

[2] These maids were enveloped by white fleecy clouds; the effigies of the Corn-maids have symbols of clouds on their heads.

Stripped of poetic embellishment, the legend has a practical interpretation. The two necessities, corn and rain, failed the ancient Hopi at some early epoch in their history, so that they were in danger of starvation, when one of their number, furnished with prayer offerings as sacrifices, sought other people who knew prayers, songs, and rites to bring the desired gifts. In order to learn these charms, he was initiated into their priesthood by this foreign people, and to make that adoption complete, married one of their maids, and, to save his brethren, he brought his bride and offspring to live with his own people. Her children were like those of her family (the Snake clan) and unlike his, and hence trouble arose between them. The mother returned to her own land and the father also sought a new home. Their children inherited the prayers and songs which bring corn and rain, and they were ancestors of the present Snake people.[1]

So it is, I believe, that every year, when the proper time comes, the men of the Snake family who have been initiated into the Snake fraternity, and the descendants to whom these prayers, songs, and fetishes were transmitted, assemble, and in order that their work may resemble the ancestral, and thus be more efficacious, they gather the reptiles from the fields, dance with them as of old, personating their "mother," the Corn and Mist maids, in the kiva dramatization, and at the close of the dance say their prayers in hearing of the reptiles that they may repeat them to higher deities. In other words, they strive to imitate the conditions, so far as possible, which tradition ascribes to that favored place of the Snake people, where corn is plentiful and rain abundant. The worship of a Great Snake plays no part, but the dance is simply the revival of the worship of the Snake people as legends declare it to have been practiced when Tiyo was initiated into its mysteries in the world which he visited.

In the same way we may explain the Flute observance as a ceremony for the fructification of corn and production of rain. The Flute-youth also obtained as his bride a Corn-mist maid. Her children were not serpents, but ancestral members of the Flute clans, and when the descendants celebrate their dance, representatives of her people take part.

The nucleus of the Hopi confederacy is said to have been formed by a consolidation of these two phratries, the Snakes and the Flutes, who are reputed to be of the same blood, since their mothers were of the same people. But the mother of the Snake people, *Tcüavcuqti*, in olden time gave birth to reptiles, the elder brothers of Snake men. Striving to reproduce the ancestral ceremonials, representatives of the legendary participants are introduced, and these are the reptiles which are

[1] Notwithstanding strong claims are made to the contrary for other societies, I think there is evidence of an intimate relationship between the Snake priesthood and the Snake phratry, as I have already elsewhere shown. This conclusion is likewise supported by Hodge's study of the Keresan and Tanoan clans. There are, of course, many priests in the Snake fraternity at Walpi from other phratries, but the majority, including the chief, are from the Snake people.

gathered into the kivas. They are washed,[1] because everyone who takes part in a ceremony must first bathe as a purification.

While this theory of the Snake dance is plausible, it offers no explanation of why the reptiles are carried in the mouths of the priests. It can readily be seen that it presupposes that they dance in the plaza with the priests, but why are they not simply carried in the hands? For this I confess I have no adequate explanation, but the fact that they are carried in the hands as well as in the mouths at Oraibi is suggestive, especially if the Oraibi celebration is the most primitive. If we suppose that the Oraibi method is intermediate in development between that of Walpi and the ancestral, we may suppose that formerly the participants danced with the snakes in their hands. Some daring priest, for a sensation, still holding the reptile in this way, put its neck in his mouth, possibly to prevent its coiling and hiding its size. That method was startling and was adopted by all, a condition which persists at Oraibi. A further evolution of the custom would be the removal of the hands, when the reptile would be carried wholly in the mouth, as at Walpi, Cipaulovi, and Cuñopavi.[2]

We have knowledge of pueblo peoples where the custom of carrying reptiles in the hands still persists, or survived to within a few years, but that does not prove that Tusayan derived its dance from that source. The participants in the Keresan Snake dances probably did not carry the reptiles in their mouths. In Espejo's reference to the Acoma variant, in 1583, no mention is made of this startling method of handling reptiles, and it would hardly have escaped mention had it been noticed, as it must have been had it existed. Mrs Stevenson, in her valuable account of the Snake dance of Sia, does not mention the custom of putting the snake in the mouth, but speaks of the Sia priests as carrying them in their hands. The Hopi claim that the Keresan priests never put the reptiles in their mouths. Thus the evidence, such as it is, seems to point to the conclusion that the habit was locally developed in Tusayan.

The public exhibition, called the Antelope dance, on the afternoon of the eighth day, is evidently connected with corn celebrations, for at that time a wad of cornstalks and melon vines, instead of the reptiles, is carried in the mouths of the priests, as on the following day.

The episode in the Snake kiva at Walpi, when the bear and puma personators carried cornstalks in their mouths and moved them before the faces of men, women, and children spectators, has probably the same significance.[3] The pinches of different colored sand which were taken from the sand picture of the Antelopes before it was dismantled were carried to the cornfields, as symbolic of the different colored corn they hoped their prayers would bring conformably to the legend of its efficacy in that direction.

[1] Journ. Amer. Eth. and Archæol., Vol. IV, pp. 81–86.

[2] The same method appears to have existed elsewhere. American Anthropologist, Vol. VI, No. 3, 1893.

[3] Journ. Amer. Eth. and Archæol., Vol. IV, pp. 62, 63.

While this bifid element of corn worship and rain ceremonials runs through the whole festival, that part of it which pertains to rain-making is most prominent in the work of the Snake priests, while corn rites pertain to the Antelopes. The two elements are interwoven, but, as would naturally be the case, the corn rites are most prominent in the kiva celebrations of the Antelope priests. The Antelope chief controls the ceremony, and his priests dance with the wad of cornstalks in the Corn dance.[1]

My efforts to discover the identity of the asperger who calls out the Keresan words, "*Tcamahía*," etc,[2] at the *kisi*, have not been rewarded with great success. He apparently is not represented at Cipaulovi and Cuñopavi, but is personated at Oraibi and Walpi. He alone wears the coronet of cottonwood, and his body is characteristically decorated. Undoubtedly he is not one of the Antelope priests, for he takes no prominent part in Antelope secret rites. He is not a Snake priest in function or dress. Two facts throw a glimmer of light on his identity. The words which he calls out are Keresan words, and in the legend[3] of the Snake hero, "*Tcamahía*" is said to have left the Snake people and to have been joined by other clans at the Keresan pueblo, Acoma. In addition there may be quoted the statement of the Antelope chief that a personified representative from Acoma joins them biennially and assists them in the public exhibition of their dance. It seems as if the asperger who utters the Keresan invocation may personate a Keresan visitor, the ancestral wanderer, who left the Snake people in ancient times, and met other people from another direction at Acoma. His dress and speech are different, for he is not a Hopi; he is of the older stock, known by the same name as the ancient stone implements on the Antelope altar, *tcamahía*, the ancients, whom some of the Hopi claim did not come upon the earth through the same *sipapû* as themselves, but who at their advent were living in the far east.[4]

I have given much thought to the question why Antelope priests are so called, and what connection there can be between the antelope and the snake in this nomenclature. At one time I even doubted whether I could believe my Hopi friends in their statements that they were Antelope priests, notwithstanding their name, *Tcüĭbĭcympkiya*, has the

[1] The erroneous statement that the "hugger" in the Snake dance is an Antelope priest is republished in many accounts of the Snake dance. This inaccuracy arose from the fact that in the Antelope dance an Antelope priest carried the wad of cornstalks and vines. Throughout the Snake dance all the Antelopes remain in line, singing, and holding such reptiles as are passed to them by the gatherers, but the "hugger" in the Snake dance is always a Snake priest.

[2] Journ. Amer. Eth. and Archæol., Vol. IV, pp. 73, 92.

[3] Op. cit., p. 117.

[4] With our present light it would be little more than plausible speculation to conclude that the Snake dances of the Rio Grande pueblos of Keresan stock originally came from Tusayan. That the Snake dance at Sia is closely alike that in Tusayan there is no doubt, and that Acoma had a Snake dance in 1583 is well known. A colony of Kawaika (Keresan) once lived in Antelope valley of Tusayan, or at least there is a ruin there called by the same name as Laguna, where there was also formerly a Snake dance. The indications are that the Keresan Snake dances are of the same source as those of the Hopi, but Keresan words in the Hopi invocation may admit of a different interpretation.

root of *teübio*, antelope.[1] A study of the Oraibi altar effectually silences all doubt on that score, for the effigies of antelopes' heads form part of its paraphernalia. I have no satisfactory explanation of the connection of the two priesthoods, but offer this suggestion: The Ala or Horn people, now identified with the Flute, originally lived with the Snake people, possibly as two phratries. When they separated, in an ancestral home, a majority wandered off with the Flute people, but a few remained with the Snakes. The predominating clans gave their names to the two groups, but although a number of the Ala people remained with the Snakes, it was not large. These Ala or Horn people were Antelopes, and their sacerdotal descendants are the Antelope priests; but the clans were small and became extinct, and the chiefs came from the predominating Snake family. The old name of Antelope remained, and their symbol in effigy persists on the Oraibi altar, but the clan was lost for a time.

Among the Flute branch the Ala people were vigorous, and retained both blood and name, so that when Snake and Flute people came together again, in Tusayan, they recognized each other as kin. At that time, indeed, the Horn family existed in Walpi in Alosaka, and he was naturally sent to spy out the character of the Flute men when they came. This personage is still represented in the Flute dance at that pueblo, as I have elsewhere described.[2]

Summing up the foregoing speculations, I am led to state the following probabilities which may be used as suggestions in future attempts to divine the meaning of the Snake dance. That the ceremony is a rain-making observance can not be doubted, and the nature of many acts shows that it is likewise tinged with sun worship. To these must now be added corn or seed germination, growth and maturity, implied in the somewhat misleading name "Corn-dance," a dominating influence in every great rite of Tusayan. I am inclined to believe that the Snake dance has two main purposes, the making of rain and the growth of corn, and renewed research confirms my belief, elsewhere expressed, that ophiolatry has little or nothing to do with it. If there is any worship of the snake, it is of such a nature that it may be more correctly designated ancestor worship. Nor does it appear to me that the snake, as here used, is wholly a symbol of water, as the frog, tadpole, or dragonfly. The reptile is introduced as a totemic personation by the society of the Snake phratry to reproduce ancestral conditions in which the ceremony was performed as the legend indicates. The same thought is expressed in a similar way in widely different Tusayan ceremonies. Take any one of the *katcinas*, for instance; they do not introduce the totemic animal, to be sure, in the *Katcina* dance, but they personate it by wearing masks. They thus attempt to resurrect the

[1] Note likewise the element *teü* in *Teüawympkiya*, Snake priest, and *Teübwympkiya*, Antelope priest.

[2] Journal of American Folk-lore, Vol. VII, No. XXVII, p. 287.

ancient performers or dramatize archaic celebrations. Where the drama induces them to introduce certain mythic animals, practical reasons lead them to personate what they can not obtain. They personate the duck (*Pawik*), and it is believed when they don the mask of *Pawik*, they become *Pawik katcinas*, and thus they perform the ceremony as did their totemic ancestors. Reptiles, however, are easy to obtain; their personation by men is therefore not necessary, and most tenacious of all in its influence, the presence of the snake is a startling component which fascinates and survives.

This theory implies but does not necessitate former belief in totemic descent. Certainly the evidence which we have leads us to believe that the Snake people, with a snake totem, believe they are descended from the Snake-woman, or if they stoutly deny descent from reptiles at present, may have once held it. Their denial, however, is only so much evidence, and is not necessarily decisive proof. White men as well as Indians deny many things which the comparative scientific method demonstrates to be true.

RESEMBLANCES TO THE KERESAN SNAKE DANCE

The valuable article by Mrs Stevenson gives us about all that is known of the character of the Snake dance among the Keres. Although Hodge[1] has found evidence that this ceremony was of late introduction in Sia, we may rightly suppose that the celebration described by Mrs Stevenson gives an idea of its general character among Keresan communities. I have already shown the points of similarity of the Snake dance of Walpi and that of Sia, as described by Mrs Stevenson, and have called attention to the probable meaning of those similarities, viz, derivation either from each other or differentiation of both from the same culture. The studies of the three Tusayan variants of the Snake dance, which are described in the preceding pages, add further evidence of relationship between the Tusayan and Keresan Snake dances. As would naturally be suspected, the Sia ceremonial differs more from any one Tusayan variant than the Tusayan dances differ among themselves, but the resemblances of the Oraibi, or most primitive, are closer to that of Sia than the highly differentiated Walpi performance.

The only other theory besides the derivation to account for these similarities of Tusayan and Keresan Snake dances would be that of independent origins, now being vigorously advocated in many quarters. While I am heartily in sympathy with this movement as a protest against wild comparisons and deductions from isolated likenesses of objects or myths, it may be carried too far. Members of the Keresan and Tusayan stocks, if we may so call them, have repeatedly been brought together in historic times. People from the Rio Grande have migrated in a body to Tusayan and built towns there or become assimilated with the sedentary inhabitants of that province. So, likewise, other peoples who once lived in Tusayan have moved back to the Rio Grande, and their descendants now form a component of pueblos like Laguna, Sandia, and others. This fact in itself is indicative of resemblances in ceremonials among these separated peoples, and when in studying the Snake dance of Sia and Tusayan we find many likenesses—not one or two resemblances in symbols and paraphernalia, but many resemblances in minute details—we rationally conclude that they are derivative and not of independent origins, due to a similar mind acted upon by a like environment.

[1] American Anthropologist, April, 1896, p. 134. Introduced by the "Cochiti somewhat more than thirty years ago."

The resemblances between Tusayan and Keresan Snake dances, which become more detailed as we study variants of the former at Oraibi and the Middle Mesa, render it less probable that two ceremonials coinciding in so many particulars originated independently. I hold, however, that we can not yet satisfactorily answer the question whether the Tusayan Snake dances were derived from the Keresan, or vice versa, or whether both differentiated from a common source.

Hodge[1] favors the idea that "the former Laguna Snake rites were introduced from the Hopi rather than from Acoma, where its influence was so slight as to leave not even a traditional trace," and he regards it quite likely that the Snake ceremony performed at Laguna only twenty years ago had its origin among the Hopi, and that it came, not "probably from Oraibi," as the Laguna people say, but more likely from the now ruined pueblo of Kawaika, whose name adhered to the newly founded pueblo near the lagoon. The people of the old "Kawaika" pueblo in Antelope valley came to Tusayan originally from the "far east," probably the Rio Grande. The theory that the Laguna Snake ceremony was derived from those Kawaikas who settled in Tusayan implies, of course, that some of them returned when Laguna was settled, which is possible; but the question whether the Acoma people did not have the Snake dance before western Kawaika was built, or before colonists left the east to settle in Antelope valley, is pertinent. If it had, as I suspect it did, the introduction of the Snake cult in Laguna from Tusayan pertains only to one Keresan locality, and we have yet to show that Acoma derived it from Tusayan. The Keresan songs and invocation in the Tusayan rites admit of but one interpretation. They at least were derived from Keresan sources.

The presentation of the Snake dance and accompanying Snake rites at Oraibi is closer to that of Sia than any of the Tusayan variants, and everything goes to show that it is the most primitive. The Walpi dance, on the other hand, has become more specialized, and is the most unlike the Sia as described by Mrs Stevenson;[2] but the question whether the Tusayan Snake cultus was derived from the Keresan, or vice versa, remains unanswered.

The meaning of the Snake dance can not, I believe, be made out completely without comparative studies, and can not be obtained from living priests. As pointed out by Tylor, in speaking of the religions of the great nations, so in that of Tusayan—

> In the long and varied course in which religion has adapted itself to new intellectual and moral conditions, one of the most marked processes has affected time-honored religious customs, whose form has been faithfully and even servilely kept up while their nature has often undergone transformation. . . . The natural difficulty of following these changes has been added to by the sacerdotal tendency to ignore and obliterate traces of the inevitable change of religion from age to age, and to convert into mysteries ancient rites whose real barbaric meaning is too far out of harmony with the spirit of a later time.[3]

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[1] Op. cit., p. 135.

[2] Eleventh Annual Report of the Bureau of Ethnology.

[3] Primitive Culture, Vol. II, p. 363.

I have no doubt that at some future time enough material will be collected to enable the ethnologist to give a rational explanation of the meaning of the Snake dance from comparative studies, but I doubt very much whether the Tusayan priests now know its original meaning. The trail for the ethnographer is, however, plain; it is highly essential that renewed efforts be made to record more accurately than has yet been done the unknown details of the Tusayan Snake dance before it is finally abandoned or transformed by modifications. Whatever current explanations are now regarded as orthodox by the priests should be given weight as evidence, but not regarded as decisive.

Of more than usual interest in a study of the distribution of the Snake ceremonials is the following reference, which I quote without comment:

> It was discovered [that] the Cocopahs, like the Moquis of Arizona, practice the Snake Dance ceremony. Not far from their village is an old adobe house especially constructed for this purpose. Here they annually resort, to avoid publicity, to have their Snake dance. Rattlesnakes are taken to this house, where the people of the Snake clan congregate and perform their hazardous ceremony. (From letter in *Chicago Tribune*, dated Pomona, Cal., October 31, 1895?)

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[1] From the varied and scattered newspapers and magazines in which accounts of the Snake dance have been published and copied, it is almost impossible to make this bibliography complete. Reviews of works on the Snake dance, of which I have over thirty, are not mentioned.

The author has not completed his studies on the Snake dance, and would be glad to communicate with other students on this subject. The more important articles on the Walpi Snake dance of 1891 and 1893 are mentioned in the Journal of American Ethnology and Archæology, Vol. IV.

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